

MIND

A QUARTERLY REVIEW

OF

PSYCHOLOGY AND PHILOSOPHY.



I.—HENRY SIDGWICK.

BY LESLIE STEPHEN.

I HAVE undertaken after some hesitation the task of writing an obituary notice of Henry Sidgwick for this journal, which owes so much to him both as a contributor and, for many years, as a financial supporter. I could not now try, even if I held myself to be more competent than I am, to give any estimate of his work in philosophy. Readers of MIND have formed their own judgment in that matter. I am, however, qualified to say something of the man, partly because I was for many years honoured by his friendship; and more because I have been enabled to fill up the gaps in my own knowledge by the help of those who were in closer relations to him.¹ Though I hope that I did not wholly fail to appreciate Sidgwick during his lifetime, I can now see, not without regret, that I had scarcely recognised to the full the singular merits of one of the purest and loftiest natures of our generation. I think, too, that a clear appreciation of

¹ Mrs. Sidgwick has been so good as to give me information and has, in particular, allowed me to make use of a brief autobiographical fragment, written during his last illness, from which I have quoted some sentences. I have also to express my warm thanks to Mr. Arthur Sidgwick, to Dr. Jackson of Trinity College, to Dr. Venn of Caius, to Prof. Ward and to Prof. Maitland. Interesting notices by the Master of Christ's College (in the *Cambridge Review* for 25th October); by Sir F. Pollock (in the *Pilot* for 15th September); by Mr. Masternan (in the *Commonwealth* for October) have also been useful.

the man will throw some light upon the philosopher, though I must be content to indicate very briefly the general result.

Henry Sidgwick, born 31st May, 1838, was the third (and second surviving) son of the Rev. William Sidgwick. The father was the son of a cotton-spinner at Skipton, graduated at Cambridge in 1829, married Miss Mary Crofts and died as headmaster of Skipton Grammar School, 22nd May, 1841. Henry was sent to Rugby in September, 1852, after some time at a preparatory school. His mother took a house there in 1853. Sidgwick says that though 'successful in schoolwork' he had not been 'altogether happy' at the house where he had previously boarded, and he remained 'inobservant and bookish'. He was not of the Tom Brown type. The chief influence¹ upon him at this time was that of his second cousin, E. W. Benson, who afterwards married his sister and died as Archbishop of Canterbury. Benson became a master in the school in 1852 and had already helped Sidgwick in the study of Sophocles. Though not his tutor, Benson did much to stimulate Sidgwick's perception of the charm of classical literature, and by certain religious utterances 'startled' him into a reverential appreciation of the 'providential scheme of human history, which was not soon to be forgotten'. Sidgwick went to Trinity College, Cambridge, instead of standing in accordance with Rugby tradition for the Balliol Scholarship, because he knew Benson's affection for Trinity. His one ideal was to be a scholar as like his cousin as possible. For the present, Sidgwick was a thoughtful schoolboy of unusual precocity and the highest promise as a scholar. In 1855 he left Rugby as senior exhibitioner.

At Cambridge Sidgwick was probably the youngest man of his year. His career was a series of triumphs. He won a Bell Scholarship in 1856; the Craven Scholarship in 1857; the Greek Epigram in 1858; and graduated in 1859 as thirty-third wrangler and senior classic, winning also the first Chancellor's Medal. He was elected to a Trinity Scholarship in 1857, and in 1859 became fellow and assistant tutor of his college. The normal sequel to such achievements would have been a rise to the highest academical or ecclesiastical positions. He had, however, been led to a pursuit which promised no such tangible rewards. His autobiographical fragment was written to explain how a central aim had determined the course of his intellectual life even when it

¹ See Sidgwick's interesting reminiscences in the *Life of Benson*, vol. i., pp. 145-151 and 249-255.

seemed 'most erratic and fitful'. He fortunately wrote enough to explain how this aim was suggested to him and affected his first philosophical studies. In the first volume of this journal Sidgwick gave an account of the position of such studies at Cambridge. The indifference of an earlier generation had been finally broken up by the influence of Whewell. Whewell had lectured upon Moral Philosophy; he had introduced a paper upon philosophy into the fellowship examinations at Trinity, and he had procured the foundation of the Moral Sciences Tripos in 1851. A series of eminent lecturers at Trinity, Julius Hare, Thirlwall and Thompson, the last of whom had become Greek professor in 1853, had encouraged the study of Plato and Aristotle. The new tripos, however, had flagged, and was only admitted as a qualification for a degree in 1860. Sidgwick, absorbed in his studies for the old triposes, did not become a candidate; and he received no impulse from the official system. Cambridge, however, was to gain a philosopher by a kind of accident. In the beginning of his second year Sidgwick was invited to become an 'Apostle'. The invitation implied a high compliment from his ablest contemporaries. He fortunately accepted it after some hesitation in admitting a distraction from his regular studies. The effect was remarkable. The society has from the days of Tennyson and Maurice included a remarkable number of very eminent men. They preserved the tradition of the famous 'band of youthful friends' described in "In Memoriam". To discuss all topics with perfect frankness and with 'any amount of humorous sarcasm and playful banter' was the practice; and absolute candour the only duty enforced by the society. Any principle might be questioned, if questioned in sincerity; and Sidgwick observes characteristically that the apostles learnt to understand 'how much suggestion and instruction might be derived from what is in form a jest—even in dealing with the gravest matters'. 'The tie of attachment to the society formed,' he says, 'the strongest corporate bond which I have known in life.' It revealed to him that 'the deepest bent of his nature was towards' the life of thought—thought exercised 'upon the central problems of human life'. He could not, however, for many years take the study of philosophy for his principal task. He was a poor man and his first duty was to support himself. He accepted, therefore, a classical lectureship in October, 1859, and for the first two years after his degree allowed himself to be 'seduced into private tuition'. He read philosophy during his vacations and was especially

interested by J. S. Mill, then at the height of his remarkable influence. He had also looked at Comte 'through Mill's spectacles'.¹ He had not broken with the orthodox doctrine in which he had been educated, but had become sceptical as to many of its conclusions and especially as to the methods of proof. He and his friends were convinced of the need of a social reconstruction guided by scientific methods and of a religious reform founded upon an examination of the evidence for historical Christianity conducted 'with strict scientific impartiality'. His striking remarks upon Tennyson's "In Memoriam" explain his feeling.² He could never read the lines beginning 'If e'er when faith had fallen asleep' (in the 124th poem) without tears. "In Memoriam" had impressed upon him 'the ineffaceable and ineradicable conviction that humanity will not and cannot acquiesce in a godless world'. He could not find rest in agnosticism, and, though accepting the methods of modern science, revolted against its atheistic tendencies. Mill's philosophy offered no solution of the great difficulties. He oscillated for a time between religious and philosophical studies, while, 'as a matter of duty,' he also gave much thought to economic and social problems. In 1862 Renan's *Études d'histoire religieuse* suggested a new line of inquiry. Wearied with the indecisive results of the controversy between theologians and agnostics, he turned to the investigation of religious history. In the autumn of 1862 he spent five weeks at Dresden, devoting his whole time to the study of Arabic under a private tutor.³ For the next three years his spare time was given to Arabic and Hebrew. He thought of aspiring to one of the two Arabic professorships at Cambridge. They had the advantage of being tenable by laymen, whereas the Knightbridge Professorship, which then expressly included Moral Theology, would probably be given to a clergyman. He gradually found that his Arabic studies would deduct too much time from the study of the fundamental problems. The comparative history of Semitic religions which he had planned, would, after all, not supply an answer to the great questions, whether the doctrine of the Incarnation could be accepted as historically true and what element of truth could be disengaged

¹ *Life of Benson*, ii., p. 249. Dr. Venn also tells me that for a time Sidgwick seemed to be much attracted by positivism.

Tennyson's Life, i., pp. 300-304.

³ His friends speak of his having studied at Göttingen under Ewald, and of his ambition to become the 'English Ewald'. I follow Sidgwick's own account in his autobiographical fragment.

from the traditional creed. He turned again towards philosophy and worked hard to qualify himself as an examiner for the Moral Sciences Tripos in 1865 and 1866.

Dr. Venn informs me of another connexion which had some influence at this time. Venn had returned to Cambridge to lecture upon moral science; the only other lecturer in the same department was the Rev. J. B. Mayor of St. John's College, to whose influence upon Cambridge studies Sidgwick (in his article upon Cambridge philosophy) ascribes great weight. Venn, Mayor and Sidgwick, with a few later recruits, formed a society which was known to their friends as the Grote Club. They dined with John Grote, then Knightbridge professor, once a term at his vicarage at Trumpington, and afterwards read and discussed papers. Grote was a most efficient moderator, supplying a keen criticism and enforcing steady abstinence from digression. A certain affinity to his young friend is suggested by Sidgwick's remark that Grote's 'subtle and balanced criticism, varied and versatile sympathy, hardly qualified him—original as he was—to be founder of a school'. Croom Robertson notes¹ that Grote invented certain phrases, 'felicific' and 'hedonics,' of which Sidgwick afterwards made use. In any case, Sidgwick's philosophical studies must have been encouraged and his dialectical acuteness sharpened in his debates with these congenial friends. In later years, Sidgwick belonged to other societies of a similar kind, especially to the Metaphysical Society, in which he crossed swords with Huxley, Mivart, W. G. Ward, Dr. Martineau, and other champions of various causes; to the 'Eranus,' a Cambridge body on the same model, and to the later Synthetical Society. They gave a most appropriate arena for the display of his characteristic powers. His early associates of the 'Apostolic' circle were struck by the 'amazing maturity' of his intellect. Though one of the youngest, he was already among the most competent. He had thought out the problems sufficiently to see the bearing of the various arguments, and would select some apparently trifling point assumed by his opponent and by a Socratic method bring out unexpected consequences with which it was pregnant. Socrates became a bore by pressing similar discussions upon unwilling ears. But Sidgwick's friends had invited the discussion, and, if a momentary vexation might follow a fair fall in the wrestling, his entire freedom from arrogance or dogmatism left no excuse for irritation. If he could not produce agreement he always

¹ In his life of Grote in the *Dictionary of National Biography*.

promoted good-will. If, as has been said, the Metaphysical Society, died 'of love,' Sidgwick was one of the unintentional assassins. His readiness to argue implied, not the pugnacity which resents contradiction, but the desire to profit by it; and the sense of humour shown in his 'Apostolic' banter always played round his arguments. The foundation of another society about 1862 illustrates one of the qualities which added an extrinsic charm to his dialectical displays. His elder brother, Mr. William Sidgwick, was at this time a resident fellow at Oxford. The brothers founded the 'Ad Eundem' Society, which met alternately at Oxford and Cambridge for purely social purposes. Philosophising, if not forbidden, was certainly not compulsory. The society flourished, and Sidgwick attended a meeting within three months of his death. I had the honour of being an early member and, without offence to my comrades, I may safely say that the expectation of meeting Sidgwick was always one of the main inducements to attend; and that a pleasant bond which kept up old college associations and enabled representatives of the two universities to forgather on most agreeable terms owed much of its strength to the Sidgwick element. The charm of Sidgwick's society could be felt even by those who cared nothing for philosophy.

The 'Ad Eundem' illustrated another point. It included at starting such men as W. H. Thompson and W. G. Clark, then public orator, who had long been the ornaments of the upper sphere of academical society. Sidgwick, young as he was, was already admitted to the friendship of his most august seniors. In the following years, he gained the respect of the upper academical circles, especially of the more intellectually disposed, and his influence became potent among the younger dons. The first great changes in the university system had taken place during Sidgwick's undergraduate career. The proposal to abolish religious tests had afterwards come to the front: and to carry a bill for that purpose through Parliament was understood to be a necessary preliminary to further reforms. Sidgwick took an important, though necessarily a subordinate, part in the agitation. In Trinity he was one of a body of fellows led by J. L. Hammond, a man of singular charm who was prevented by ill health from making a mark proportioned to his great powers. In December, 1867, Sidgwick supported (and probably proposed) a resolution for abolishing the declaration imposed by the college statutes. It was rejected; but Sidgwick's later action had an indirect effect in securing the adoption of the policy. In June, 1869, he accepted a lectureship in Moral Philosophy

in exchange for the classical lectureship, and now made up his mind to attempt to found a philosophical school in Cambridge. Meanwhile, he was pressed by the question whether he had a moral right to retain his fellowship. The problem involved some delicate casuistry. He had qualified himself for the fellowship by a sincere declaration of belief. Could he hold it, now that he could no longer make the declaration? It might be urged that the legal measured the moral obligation and that, as no one had a right to inquire into his belief, he had a right to the position without regard to his present beliefs. He tried, he says, to settle the point 'on general principles'. But Sidgwick was pretty sure to be biassed by his own clear interests—that is, in the direction opposed to them. Anyhow, he resigned his fellowship in October, 1869. Sir George Young, a most competent witness, says in the *Cambridge Review* that the effect of his resignation was very great. Fellows of other colleges followed his example. An important meeting, held at Cambridge in December, showed that a majority of residents was in favour of the abolition; and a similar meeting at Oxford two days before had been suggested by a knowledge of the intended meeting at Cambridge. The parliamentary action followed which led to the final abolition of tests in June, 1871. How far Sidgwick's action had all the influence ascribed to it can hardly be decided. Sidgwick would have been the first to condemn any exaggeration of his own part. I must therefore note that the parliamentary proceedings had shown clearly that the main obstacle to a liberal success was the abnormal slowness of the process of converting Gladstone upon such questions, and that a more popular argument was the disqualification for fellowships of the senior wrangles of 1860, '61 and '69. But there can be no doubt of the great moral significance of Sidgwick's action. He was giving up for a scruple, which to most people seemed refined, his chief support and as it seemed the chances of academical position. Happily by that time, the fellows of Trinity were singularly free from any theological bigotry. Sidgwick was permitted to retain his position as lecturer with the social privileges of a fellow.

Sidgwick now began the course of teaching which continued through his life. In October, 1875, he became Prælector on Moral and Political Philosophy in Trinity; and in 1883 was elected to the Knightbridge Professorship upon the death of Prof. Birks. He had been a candidate for the post in 1872, when Birks succeeded F. D. Maurice. He had not then published his great book. In 1883 his fitness

was so obvious that the election might be almost said to be by acclamation.

Sidgwick's influence as a lecturer was both important and characteristic in kind. The position of the study at Cambridge was so far unfavourable that his classes were necessarily very small. Sidgwick himself expressed some doubt as to the utility of metaphysical studies for men at the early age of his hearers. A youth, not endowed with a special predisposition, is more apt, he might think, to learn a philosophical jargon than to gain a clear insight into the real issues. This view prevented him at a later period, according to some of his colleagues, from pressing the claims of his own faculty so vigorously as they thought desirable. His own example, however, proves sufficiently that an aptitude for such study may show itself early and be well worth cultivation. I lately heard an intelligent person inquire what was the meaning of 'ethics'. Some explanation being offered, the inquiry arose how it could be possible to devote volumes to setting forth the objections to breaking the ten commandments. For practical purposes, perhaps, the state of that person was the more gracious; but Sidgwick's *Methods of Ethics*, of which his lectures were now giving the substance, would have answered the question effectually. To the select few his speculations revealed whole fields of interesting speculation. Sidgwick, of course, could hardly found a school in the ordinary sense. A 'Sidgwickian,' as connoting acceptance of a definite philosophical platform, would be almost a contradiction in terms. At any rate where there were two Sidgwickians, they would necessarily resolve themselves into a debating society. Sidgwick had not the attraction of the teacher who has attained definite results and can give the watchword to a band of enthusiasts. His influence was free from the defects, if it had not the characteristic merits of such a position. It did not lead to ignoring difficulties but to facing them fairly. Though not claiming to have solved the great problems, he was fully convinced both that they were soluble, and that a man might well devote his life to hastening the solution. His subtlety in seeing difficulties and his candour in admitting them did not lead to a mere play of skilful dialectics. He set his hearers' minds to work and to work in the interest of truth. Several of his hearers have turned his lessons to good account; and have acknowledged most emphatically the debt which they owe to him. Close contact with such a man was no small part of 'a liberal education'. For Sidgwick had the ethical genius; and was as sensitive to the moral as some men to

the æsthetic aspects of life. His transparent simplicity, extraordinary alertness of mind and intense love of truth enabled him to preach by the effectual method of personal contagion.

Meanwhile he had already taken up a function which absorbed much of his energy and fully illustrates his moral enthusiasm. Devotion to philosophy would not, he held, justify abstinence from the active duties of life. He desired to do something for the good of mankind and was naturally led to promote the education of women.¹ Girls had been admitted to the Cambridge examinations; and in the autumn of 1869 Sidgwick thought out and proposed a scheme for providing lectures for the candidates. It was warmly taken up, and its success suggested the advantage of providing a house for the students in Cambridge. Sidgwick made himself responsible for the rent of such a house and in 1871 invited Miss Clough to undertake the superintendence. This again led to the formation of a company in 1874, to which Sidgwick subscribed money as well as labour; and to the opening of Newnham Hall, built by the company in 1876. In that year Sidgwick married Miss Balfour. It would be as impertinent as happily it would be superfluous for me to speak of that event in any other way; but its bearing upon this part of his career is matter of public knowledge. When in 1880 the North Hall was added to Newnham, Mrs. Sidgwick became vice-president, and the Sidgwicks took up their residence there till her resignation two years later. Sidgwick was a main supporter of the important measure by which, in 1881, women were admitted to the honours examination, and a great stimulus given to the movement. Upon Miss Clough's death, in 1892, Mrs. Sidgwick succeeded to her post, and the Sidgwicks resided in the college during the remainder of his life. Throughout the whole of this period Sidgwick, who had been the chief founder of the organisation, was at the heart of the resulting movement: suggesting the schemes which ultimately succeeded, advising Miss Clough through all her difficulties, taking the keenest interest in all the details of management, winning the affection of teachers and students by his social charm and judicious counsels, contributing munificently in money and taking the lead in the university legislation which was required by the novel experiment. He was always a member of the Council of Newnham, and was also for some years connected with the college at Girton. The main difference between the two

¹ I refer to the life of Miss Clough for full details.

bodies was that Sidgwick and the supporters of Newnham were less anxious than their friendly rivals to assimilate the education of women precisely to the system established for men. For Sidgwick may be claimed, without hesitation, a leading part in the remarkable changes which have transformed the whole theory and practice of the higher education of women in England.

Another set of duties fell to him in later years. The University Commission of 1877 had been appointed in consequence of proposals by Cambridge Liberals which Sidgwick helped to formulate. Not being a member of the governing body, he had no direct share in the changes made at Trinity College under the Commission. The new statutes for the university came into force in 1882. Sidgwick's value was by this time fully appreciated in the university; and in November, 1882, he became a member of the General Board of Studies created under the new system. He held this position till the end of 1899 and acted for several years as secretary. He was also a member of the Council of the Senate from 1890 to 1898. His colleagues on both speak emphatically of his conscientious discharge of his duties; his skill in debate and his power of incisive criticism tempered by unflinching courtesy. The Cambridge system went through very important changes, in which he played his part. I am not qualified, nor would it be here possible, to deal with questions of university politics; but one or two points, which I learn from Dr. Jackson, are characteristic. The new order of things raised some delicate questions. The taxation of the colleges for university purposes was made burdensome by agricultural depression. Sidgwick, with two colleagues, was appointed by the General Board to investigate the necessary rearrangement. He took the whole work upon himself: collected all the information and devised an elaborate scheme for settling the difficulty. He threw himself heartily into financial problems and Dr. Jackson thinks that he would have liked nothing better than to be Chancellor of the Exchequer. He would have 'devised an amazingly ingenious budget and his exposition would have been a marvel of lucidity and address'. His scheme failed of acceptance by an appearance of over subtlety, and Dr. Peile admits that, if ever a doctrinaire, he was so on the General Board. He delighted in framing schemes for compromise, and became at times too obstinate in adhering to his own compromise. He had allowed so carefully for all interests that any other arrangement seemed to him unjust. He was, it is also suggested, so much interested in the details as occasion-

ally to lose sight of the broader and more obvious issues. No one, however, doubted the great value of his energetic co-operation in a period of important changes. When he indicated by giving up his place on the General Board that he was probably abandoning administrative work, says Dr. Jackson, the news seemed 'almost tragic'. It was 'like the parting of a parent and child'. One most tangible proof may be given of Sidgwick's keen interest in the reforms. The university was enabled by his munificence to introduce, or to hasten the introduction, of various additions to its agencies. He supplied the funds by which Dr. Maitland, now Professor, was restored to the university as reader in law; he helped in the same way to start the professorship now held by Dr. Ward, and he enabled the university to build a museum required by the School of Natural Sciences.

Sidgwick's final retirement from the Council was partly connected with the last phase of the question of admitting women to degrees. He never wished to adopt the university system of education for women without modification, and objected in particular to 'compulsory Greek'. He supported the proposal to grant titular degrees to women, though he had at first thought it premature or imprudent. Opponents thought that it was a step which would necessarily lead to further changes; Sidgwick and his friends considered it as a compromise for an indefinite time, though they could not pledge themselves to its absolute finality. The rejection by a great majority was a blow to the party of advance. Nobody could ever suspect Sidgwick of the slightest insincerity; but the measure advocated might seem equivocal, however good the motive: and a love of compromise, though prompted by simple desire for justice, may have an appearance of diplomacy.

Sidgwick's influence was for the moment injured; but he had other motives for not again standing for election to the Council. He was anxious to finish literary work, of which it is only strange that he had performed so much under so many distractions. Besides the duties already noticed he had from a very early time (certainly from 1864) taken an interest in 'Psychical Research'. The interest was connected with his course of speculation. His ethical position led him to desire some 'direct proof of continued individual existence'. He was president of the society founded in 1882 from 1882-1885, and again, 1888-1893; and for some time edited or superintended the editing of its journal. He brought to it all the conscientious spirit of scientific investigation; and a desire to discover the truth of

alleged facts led him to investigate them with the most rigid impartiality. He was not the man to accept Don Quixote's method of testing his armour leniently when he wished it to be trustworthy. He fully recognised and helped to expose the impostures which obscured any real substratum of truth. Yet another application of his energy is mentioned in the organ of the Charity Organisation Society. He was one of the founders of the Cambridge branch in 1879, having previously belonged to the Mendicity Society. He drew up its rules, presided over the weekly meetings for many years, contributed liberally, and was president till his death. 'It will never be fully known,' it is added, 'how much of all that is best in Cambridge to-day was due to his inspiration and example.'

Sidgwick had found time in the midst of these labours to produce his three books, the *Methods of Ethics* in 1874; the *Principles of Political Economy* in 1883; and the *Elements of Politics* in 1891. He has also left work still in manuscript, a considerable part of which will, it is hoped, be published. The amount and quality of the purely intellectual work is the more remarkable considering his activity in practical directions. I have tried, however, to indicate in how many ways Sidgwick's employments fitted in with his pursuit of philosophical truth. A moralist is none the worse for some practical acquaintance with applied morality. His other work gave weight to his convictions if it limited his output within a moderate compass. Indeed, considering the temptations of so versatile an intellect to excessive discursiveness, his other occupations may well have suppressed only corollaries which though interesting would be, in strictness, superfluous.

Sidgwick had hoped that after reaching sixty he might resign his professorship to some worthy successor and devote himself to finishing his literary work. The warning that he was suffering from a dangerous disease came to him early in 1900, and was accepted with the most admirable courage and simplicity. He afterwards read a paper at the Synthetic Society and took part in the debate with his usual brilliancy. Friends who met him still later, without being aware of his position, found the old charm in his conversation and were only impressed by a rather more marked tone of friendly interest. He resigned his professorship; quietly wound up his affairs; and parted from life as nobly as he had lived it. He died on 28th August, 1900.

A word or two upon personal characteristics may be permitted. Sidgwick had no great physical power. He suffered

a good deal from hay fever, and in late years from insomnia. He soothed hours of wakefulness by reading a great quantity of novels, and remembered their plots with singular retentiveness. Dr. Peile records that when meditating he liked to take a sharp walk, often 'breaking into a little run'. The starts indicated, perhaps, the flashing of some new thought upon his mind. The vivacity of such impressions made him one of the best of talkers. The difficulty of describing conversation is proverbial, and when I seek for appropriate epithets I am discouraged by the vagueness which makes them equally applicable to others. Henry Smith, for example, who often met Sidgwick at the 'Ad Eundem,' had an equal fame for good sayings; and both might be credited with unfailing urbanity, humour, quickness and other such qualities. Their styles were nevertheless entirely different, while to point out the exact nature of the difference is beyond my powers. Smith, perhaps, excelled especially in the art of concealing a keen epigram in a voice and manner of almost excessive gentleness. Sidgwick rather startled one by sudden and unexpected combinations and arch inversions of commonplace. His skill in using his stammer was often noticed. His hearers watched and waited for the coming thought which then exploded the more effectually. Sidgwick not only conceded but eagerly promoted contributions of talk from his companions. He would wait with slightly parted lips for an answer to some inquiry, showing a keen interest which encouraged your expectation that you were about to say a good thing, and sometimes, let us hope, helped to realise the expectation. He differed from Smith—who preserved a strict reticence upon the final problems—by a readiness to discuss any question whatever, if it were welcome to his companions. He was not only perfectly frank but glad to gain enlightenment even from comparatively commonplace minds. Johnson commended a talker who would fairly put his mind to yours. That marks one of Sidgwick's merits. He would take up any topic; made no pretension to superiority, and was as willing to admit ignorance or error as he was always fertile in new lights. He delighted in purely literary talk; and his criticisms happily combined two often inconsistent qualities: the freshness of impression which suggests a first reading of some book, with the ripeness of judgment which implies familiarity with the book and its writer. He might, I think, have been the first of contemporary critics had he not devoted his powers to better things. Sidgwick could not be unconscious of his own abilities; but was as free from arrogance as from any approach to ostentation; and, in

fact, freedom from the weaknesses of morbid self-consciousness was one of his most obvious characteristics. When he resigned his fellowship, he made no fuss about doing a simple act of duty; and when the fatal sentence was pronounced, he accepted it with perfect quietness, without complaint, and with no display of resignation. There was no merit in Boswell's good humour, said Burke, it was so natural. I had the same feeling about Sidgwick's unselfishness and high principle. I fancied that he could not really have a conscience—much as he professed to esteem that faculty—because I could not see that his conscience could ever have anything to do. He had plenty of scruples, because he saw the full complexity of any special case; but, when he had the facts properly arranged, the decision to act followed spontaneously.

I must try to indicate in a few words the relation between Sidgwick's thought and his personal characteristics. I may take for granted the singular activity and subtlety of his intellect. The whole substance of his books is logic, with a minimum of amplification or rhetoric. They are a continuous and unflagging scrutiny of the positions to be established or confuted. The subtlety again is always at the service of common sense. It is directed to secure clearness and solidity, not the construction of an elaborate system. I remember his once speaking of certain philosophies. They resemble cardhouses: you can perhaps coax your first principle into an appearance of stable equilibrium; but when you build a second upon the first and go on to a third and fourth, the collapse of the whole edifice is certain. It was therefore Sidgwick's aim to lay secure foundations on solid ground. He has given in a fragment (to be published in a forthcoming edition) a 'genetic account' of his book upon ethics. He had been repelled by Whewell's arbitrary system of intuitions, and attracted by the plain common sense of Mill's Utilitarianism. But difficulties revealed themselves which sent him to all the great moralists from Aristotle to Butler and Kant. The final result seemed to some of his critics to be a rehabilitation of Utilitarianism. He protested against this view and said that he had criticised Utilitarianism as unsparingly as Intuitionism. He had 'transcended' the difference; or (as he says in the fragment) become a Utilitarian on an Intuitionist basis. The first principle of Utilitarianism is 'the most certain and comprehensive of Intuitions'. But the reconciliation itself brings out most sharply a fundamental contrast—that, namely, between this first principle and the conflicting principle of 'rational

egoism'. It is 'reasonable' to seek our own happiness; and yet it cannot be proved empirically that this harmonises with the other reasonable principle of seeking the general happiness. Conduct, then, cannot be made 'intrinsically reasonable' without accepting a hypothesis 'unverifiable by experience'. Unless, therefore, we can believe that the moral order imperfectly realised in this world is actually perfect, the 'cosmos of duty is really reduced to a chaos' and the attempt to form a perfect ideal of rational conduct foredoomed to inevitable failure. Sidgwick, that is, had not found a final solution for the old Utilitarian difficulty. A sufficient criterion of morality could be found in the 'greatest happiness' principle; but the difficulty was to discover a sufficient 'sanction'. How much this difficulty affected Sidgwick is shown by his remarks upon "In Memoriam". He frankly admitted that he could not give a solution. Meanwhile, whatever the true answer, the effect of his elaborate scrutiny into the fundamental conceptions of Ethics gave, as I think from my own experience and that of others, the most important of all modern contributions towards a clear realisation of the conditions of approaching the problems involved.

A similar tendency marks his *Political Economy*. His early interest in social problems had led him to the subject. His love of all intellectual activities took him far into some technical discussions, upon bimetallism for example, which have little bearing upon ethics. But his main point is closely connected with the problem of what Bentham called 'self-regarding conduct'. He had been again greatly influenced by Mill. He adopts old methods, but endeavours to restate the results so as to meet later criticisms. The 'classical economists' had insisted upon the supreme importance of self-interest and had deduced the *laissez faire* doctrine. Sidgwick by a careful and acute investigation of their arguments tries to recognise the true place of the 'self-interest' principle, and to get rid of the excessive absolutism of his predecessors. He refutes in particular, the 'wage fund' theory, which had been used as an argument against the possibility of social improvement. The old rigid system is thus broken down, and free play is left for hopes of social regeneration. It is, however, equally characteristic that Sidgwick endeavours to do full justice to the importance of the self-interest principle, which had been unduly magnified into the sole axiom of political economy; and, without adopting the old *non possumus*, emphasises the necessity of appealing to experience. He

is characteristically opposed¹ to the claims of sociologists, who have jumped prematurely to general theories of society which would invalidate or absorb political economy; and to such followers of the historical school as incline to deny the possibility of anything beyond purely empirical results. Sidgwick's mixture of cautious scrutiny with a hearty respect for the common sense embodied in the old system is again conspicuous.

Both in the *Ethics* and the *Political Economy*, his common sense leads him to assign less importance than many of his contemporaries to evolutionist theories. They tend, he clearly holds, to exaggerated claims of scientific infallibility and after all leave the fundamental questions to be answered. If you could show how morality has come into being, you would not show what it actually is. The effect of his position is marked in the *Elements of Politics*. He was always keenly interested in political questions and showed his characteristic common sense in speaking of them. There is abundance of that quality in the *Politics*, when he again expressly takes up the line of Bentham and his followers. We have the old problem of the proper relation between the State and the Individual, or self-interest and public spirit. Common sense is invaluable; but I confess that to my mind it is impossible to discuss political questions effectively without constant reference to historical development; and that, from the absence of such reference, Sidgwick's book is rather a collection of judicious remarks than a decided help to the formation of political theory. He afterwards, I believe from a sense of this weakness in his method, took up some historical investigations into political institutions and delivered lectures upon the topic. I do not know whether they were sufficiently finished to justify republication, or how they might be related to the general treatise.

Sidgwick published nothing, I think, expressly treating of the ultimate problems which always occupied his mind. Friends have told me that in later life he drew rather nearer to orthodox views. The Synthetic Society, of which he was an important member, endeavours, I understand, to promote efforts towards a reconstructive process with which he no doubt strongly sympathised. He perhaps felt that he had no definite help to give to the solution of the final difficulty suggested in the conclusion of the *Ethics*, or hoped that he might be able to utter his convictions more fully when he

¹ See his "Scope and Method of Economic Science" (address to the British Association, 1885).

was relieved from the pressure of his active employments; and could complete his speculative labours, if not by offering a full answer to his doubts, yet by indicating the best method of approximating to such a result.

A meeting of Sidgwick's friends was held at Cambridge upon the 26th November. It was resolved to raise funds for some memorial; but it is not yet decided whether it should be a library of philosophical books, a studentship in philosophy or a lectureship in moral science.

II.—THE PHILOSOPHY OF T. H. GREEN.¹

BY THE LATE H. SIDGWICK.

It is said that an undergraduate once, being asked in examination to describe the economic conditions of the inhabitants of the Hebrides, stated that they "earn a precarious livelihood by washing one another's clothes". It has often seemed to me that if, after Carlyle, we take "clothes" symbolically, to denote the outward and verbal vesture of the inner life of thought—and if we add that the process of washing is sometimes performed with a disintegrative roughness which no laundress would think of applying to the delicate texture of material clothes—the phrase would aptly describe a considerable part of the industry of modern metaphysicians. I have begun with this simile to show you what I wish to avoid in the present paper: my sincere aim is to get at the real inner essence of Green's thought, and explain why it does not satisfy me: but I feel sure that I shall at best very partially succeed: and that much of what I say will appear to any disciple present to be at the most mere washing of clothes—mere indication of casual inadvertencies or inadequacies of expression—if indeed he will admit even that.

With the aim that I have described, I think that I had better begin with a brief characterisation of Green's Philosophy, as I conceive it. But here I have a certain obstacle to overcome: respect for the wishes of an old friend. For Green not only disliked being "labelled" generally—I suppose most of us do that, yet we know that labelling must go on—but he particularly objected to *my* labels for him in old

¹ A lecture to the Oxford Philosophical Society delivered 21st May, 1900—the last that Prof. Sidgwick gave. On his MS. is the following note: "For the necessary limitation of the subject, I have confined myself mainly to the *metaphysical* view expounded in Green's latest work—*Prolegomena to Ethics*—as distinguished from the ethical doctrine put forward in the same work, which I reviewed in *MIND* at the time of its appearance". See *MIND* for 1884, vol. ix., pp. 159-187. The lecture is here reprinted from his unrevised MS. as he left it.—J. W.

days. I called him a 'Transcendentalist' and I called him a 'Hegelian': and he objected to both. Accordingly, I shall to-day use neither term: but I may perhaps say that while I now admit his objection entirely as regards the latter of the two labels, I still think it overstrained as regards the former. That is, I do not see why a philosophical system so closely filiated to Kant's should repudiate the master's own designation, 'Transcendental'. But 'Hegelian' is a term that I should never have applied to the author of the *Prolegomena to Ethics*, and it is with this latest expression of his thought that I am now concerned. I think indeed that the term might be defended in relation to some of his earlier utterances; and that his thought during his life moved away from Hegel. May I give two personal reminiscences that confirm this. I remember writing to him after a visit to Berlin in 1870, and expressing a desire to "get away from Hegel": he replied that it seemed to him one might as well try to "get away from thought itself". I remember, on the other hand, that in the last philosophical talk I had with him, he said, "I looked into Hegel the other day, and found it a strange *Wirrwarr*":—the sentence startled me; and the unexpected German word for 'chaos' or 'muddle' fixed it firmly in my mind.

However that may be, I reject to-day both these old labels. The terms I now propose are 'Idealistic' and 'Spiritualistic': and, in explaining why and how I use the two, I shall at the same time indicate my most fundamental difficulty in assimilating Green's metaphysic. In brief—his Spiritualistic conclusions do not seem to me to cohere with the Idealistic premisses on which they are based. I employ the two terms, in the hope of getting rid of the variation and ambiguity in the use of 'Idealism' which in current English thought appears to me to have become quite intolerable. The definition of Idealism seemed to Kant a simple matter: it "consisted in the assertion that there are none but thinking beings, all else being merely representations in the thinking beings": that is, it analysed reality into the "spirits and ideas" of Berkeley. This doctrine I now propose to call 'Spiritualism': defining it by the characteristic that it makes a fundamental distinction between the Spirit or Subject—whether human or primal and Eternal—and its ideas, thoughts, or thinking activities. The relation between the Spirit and its thoughts or activities may be very variously conceived: the important point for my definition is that the distinction between the two should be fundamental: and such a fundamental distinction seems to me quite explicit in Green's

doctrine as well as in Berkeley's, and is implied in Kant's definition above quoted. But owing, as we know, to the development of Kant's philosophy by later thinkers, another metaphysical view has become current, which simplifies the conception of reality by suppressing or subordinating the distinction between the thinker and his thought, and simply represents the Universe as essentially Thought or Thinking Activity. This view, and this alone, I label Idealism.

But there are other views currently called Idealism, especially in English philosophical discussion, which it will be convenient to label before I concentrate attention on Green. *E.g.*, it may be held broadly that "matter in ultimate analysis is a mode of mind or consciousness," without raising the question of a conscious self or subject, or entering on the distinctions and relations between different kinds of consciousness—such as thoughts, feelings and volitions. Such view I think is often called Idealism. I propose to label it 'Mentalism' in broad antithesis to 'Materialism'. If, again, the Mentalist's ontology expressly excludes the notion of self or subject;—if, following Hume, "when he enters most intimately into what he calls himself," he fails to find any self to observe; and therefore "ventures to affirm of mankind 'in general' that they are nothing but bundles or collections of different perceptions, which succeed each other with an inconceivable rapidity"—then perhaps we may designate him as an atomistic Mentalist. But if a single word is desired, we have, I think, to take note of different results of the philosophic effort to simplify the empirical diversity of transient mental facts or states of consciousness. If—again following Hume—it is held that "all our simple ideas are in their first appearance derived from simple impressions," and that among impressions the sensations are "original" and the passions and other emotions secondary and derivative—one may properly call the doctrine Sensationalism. If on the other hand Will is viewed, as by some German thinkers of the day, as the most fundamental or essential fact of Mind, and also the "inner side" of matter, I would offer the label Volitionism. If thought or "thinking activity" is so regarded, we are brought back to Idealism in my sense. Only as to these latter terms it must be borne in mind that Volitionism in German thought is not in its origin (in Schopenhauer) atomistic, nor ever completely so in later thinkers: while Idealism, I think has never been Atomistic; it has always viewed reality as a coherent system of thought, or an essentially single and only partially self-differentiating activity of thought.

Well, this is the labelling I propose : let me briefly sum it up.

Mentalism = ' Reality is mental ' (or ' matter in ultimate analysis, consciousness ') subdivides into

Idealism = " Reality is thought " or " thinking activity ".

Volitionism = " Reality is Will or Volition ".

Sensationalism = The ultimate elements of reality are Sensations or " feelings " (in older wider English sense).

And—distinct from each and all of these three—

Spiritualism = " Reality is conscious " = thinking, willing, feeling beings

(for Spiritualism again may be Idealistic, Volitionistic, or Sensationistic, or predominantly the one or the other).

I ought to add that of these different species of Mentalism, Sensationalism at least is sometimes held as a theory not of " Reality " unqualified, but of *knowable* reality : or is even definitely combined with *Agnosticism* as regards Reality. So held it might perhaps be labelled Phenomenalism. Finally let it be understood that I do not profess to range all the subtle diversities of modern metaphysical belief under these briefly and sharply defined headings : they are, I admit, more adapted to denote predominant *tendencies* in living and actual metaphysical systems, than to characterise precisely the systems themselves.

I can now, I hope, state both briefly and clearly my view of Green's Metaphysical System. First, it is a species of Mentalism. Nature, or the world of space and time, is conceived as a single, unalterable, all-inclusive system of relations : and these relations are thought-relations ; they result from the activity of thought. So again, so far as this conception of Nature goes, the system is clearly the species I have called Idealism. If Nature is essentially a system of thought-relations, Reality is—so far—Thought. And if Thought was conceived as simply *für sich bestehend*¹—as Green had conceived it some years before—the whole system might have been purely Idealistic. Thought would then not only have made Nature, but have completed itself—its system of relating and related notions—in Spirit : so that the Universe of Reality would have been truly thought as Thought itself.

...But this is not Green's view in the *Prolegomena* : on the contrary, it is a view that he decidedly and emphatically excludes. The single all-inclusive system of thought-rela-

¹ Cf. *Works*, vol. ii., p. 11 note.

tions which constitutes nature, "implies something other than itself, as a condition of its being what it is".¹ It presupposes the activity of a thinking being, a "self-distinguishing, self-objectifying, unifying, combining consciousness" whose synthetic activity is the source of the relations by which the knowable world is unified: and we are entitled to say of this entity, that the relations which result from its synthetic action are not predicable of it. "They arise out of its presence to phenomena, or the presence of phenomena to it, but the very condition of their thus arising is that the unifying consciousness which constitutes them should not be one of the objects so related." This consciousness is therefore "not in time, not in space," etc., not "above or beyond or before nature," nor a "substance of which the changing modes constitute nature," nor "a cause of which nature is the effect": and "causation, indeed"—we are told—"has no meaning except as an unalterable connexion between changes in the world of experience". The most distinctive term for it—as "consciousness" and "mind" have wider meanings—is Spirit.

Briefly, then, a spirit's thinking activity is the source of a system of notions, by which the world is constituted, but it cannot itself be thought under any of these. It is the former proposition that leads me to call Green's view Idealistic: it is the latter which leads me to call it Spiritualistic, according to the definition before given.

For it is not only the Divine Spirit, that constitutes the world, which is affirmed incapable of being itself conditioned by any of the relations that result from its combining and unifying action: this is no less true of human minds so far as they have knowledge, and understand the world, to however partial and limited an extent. Indeed, finite minds are not merely similar in this respect to God, and analogously active—in unifying and combining—each within the limits of his own experience: this likeness, this analogy of action is, in Green's view, an adequate ground for inferring *identity*, between God and finite minds, so far as the latter are not merely sentient but intelligent. 'Man' is for Green, as for common sense, a composite or dual being: but the duality seems to be different. For modern Common Sense—at least—man is composed of Mind and matter, and feelings no less than thoughts—as contrasted with cerebral nerve-processes—are regarded as mental facts. For Green, on the other hand, sentience, and even consciousness in a certain

¹ *Prolegomena*, § 52 f.

sense, belongs to the nature constituted by thought-relations: but so far as knowing, each man's consciousness is nothing but the eternal consciousness itself, reproducing or realising itself in a limited form in connexion with the man's animal organism which it makes its vehicle, and whose sentient life it uses as its organ. It is as such a reproduction or realisation of the one Divine Mind that a man is also a "self-distinguishing, self-objectifying consciousness," a "self-conscious personality" or briefly a "spirit".

"Realise or reproduce." The alternatives are rather startling: so vast an issue appears to be left an open question by the disjunction thus quietly suggested. For if we say "realise," God and his complete knowledge, and Nature, the single all-inclusive system of relations appear to lapse into potential existence; reality being restricted to finite spirits and their partial and imperfectly understood experiences. We should thus get an Idealism curiously correspondent to the sensationalism of J. S. Mill; possibilities of thought taking the place of the latter's possibilities of sensation. Can we infer from the alternative phrase that Green recognised this or something like this as a tenable metaphysical position? I cannot say: but one who has read the *Prolegomena* through can hardly doubt that he decisively adopted the other alternative. The conception of One Divine Eternal Spirit, who really *is* all that the human spirit is capable of becoming, is essential to his ethics: God is the ideal of the human spirit, but he is an ideal completely realised.

This then is Green's 'Spiritualism' as distinguished from his Idealism. There is, of course, an essential connexion between the two: my point is that there is also, in a certain sense, an essential opposition. The Spirit makes nature: but it is and must be a non-natural principle. That is it constitutes nature by a system of relations which result from its action as thinking: but for that very reason these thought-relations "are not relations of it, not relations by which it is itself determined". For, once admit it to be otherwise, once suppose that any of the thought-relations resulting from its thinking activity are applicable to it, then it becomes *pro tanto* a part of nature: its non-naturalness can no longer be maintained, and the *pivotal* notion of the whole system is removed.

We come, then, to the questions which I primarily offer for discussion this evening. Is this combination of Idealism and Spiritualism—as I have distinguished them—really thinkable? and does Green really succeed in thinking it? I am compelled to answer both questions in the negative,

but I shall devote my own discussion chiefly to the second question.

Let us first take Green's positive account of Spirit, and ask, point by point, whether we can definitely think the qualities or functions he attributes to it, without in so thinking, predicating of it some of the relations which—according to Green—result from its combining and unifying activity, and are therefore not properly predicable of it.

First he conceives it as *one* and *many*: one Divine Mind and many reproductions of it; here we have relations of number.

Secondly the human spirit is identical with the Divine:—the latter is said to be a "spirit which we ourselves are": yet again it is a "reproduction" of it and a reproduction is different from the original. Here we have a peculiar and difficult combination of the relations of identity and difference.

Again, a Spirit is a "self-distinguishing" consciousness: that means, I suppose, that it attributes to itself unity, identity, difference from nature and, I suppose, from other spirits. But again it is a "self-objectifying" consciousness: that is, it conceives itself as an object: and therefore in a relation of similarity with nature, so far as both spirit and nature must be thought as having whatever attributes are connoted by the word "object". Finally, it is a 'unifying' and 'combining' consciousness: but by each of these terms its function is conceived in a relation of similarity to processes that we conceive as occurring in Nature: Nature is continually presenting to us combinations and unifications, as well as separations and divisions.

In short, taking Green's descriptive terms, and endeavouring to think by means of them, we find that we are inevitably conceiving Spirit as conditioned or determined by the very same relations that we use in determining phenomena.

Turn now to the negative characterisation that he gives of Spirit, to emphasise and impress on us its non-naturalness. It is, he says, not in time, not in space, not a substance, not a cause. But can he really think it thus? Let us see.

First the Spirit is "not in Time". If so, we are to understand not merely that it does not change but that it does not perdure; since changing and perduring are equally time-determinations. Hence when Green speaks of the Divine Spirit as "eternal," we must understand him to intend to mean not "everlasting," but merely the same as when he speaks of it as "not in time". But can we conceive this to be his meaning when he speaks of it as

"a consciousness for which the relations of fact that form the object of our gradually attained knowledge, *already* and *eternally* exist": or when he speaks of the "best state of man as *already* present to a divine Consciousness"? Must we not think of the divine Consciousness as "in time" if we think of it as "*already*" such and such. So again, when speaking of the problem suggested by the constant spectacle of unfulfilled human promise, he says "we may content ourselves with saying that the personal self-conscious being, which comes from God, is for ever continued in God":—surely here God is conceived as eternal in the sense of abiding "for ever". Again, it is because the divine mind reproduces itself in the human soul, that that soul is said to have a "spiritual" demand for an "abiding satisfaction of an abiding self"; but how could this be legitimately inferred unless the Divine Mind itself were conceived as abiding and perduring through Time?

But if "in time," why not a substance, since substance is for Green the permanent correlate of change? and can we avoid thinking of the Eternal Mind as the permanent correlate of the processes of change and development essential to finite minds?

Finally, can we conceive the Eternal Consciousness—following Green's thought—as not a cause? He tells us that it is a "source" of the relations which constitute Nature; that they "result from" its combining and unifying action; that it "makes the animal organism its vehicle"; that it "is operative" throughout the succession of events which constitute the growth of the individual mind; that it "acts on the sentient life of the soul" and "uses it" as its organ. Are not these all terms implying causality? And yet he says—arguing against Kant—that "causation has no meaning except as an unalterable connexion between changes in the world of our experience".

Green ultimately sees the inconsistency:—though I think he carries the exposition of the *Metaphysics of Knowledge* much too far without hinting at it. But I will not digress into mere clothes-washing. Let us rather try to understand the explanation that he ultimately gives. It is, I think, the most difficult passage in the *Prolegomena*:—

"When we transfer the term 'cause' from the relation between one thing and another within the determined world to the relation between that world and the agent implied in its existence, we must understand that there is no separate particularity in the agent, on the one side, and the determined world as a whole on the other. . . . The agent must act

absolutely from itself in the action through which that world is—not as does everything within the world, under determination by something else. The world has no character but that given it by this action; the agent no character but that which it gives itself in this action.”¹

It should be added that the “action,” in the same passage, is stated to be “that inner determination of all contained in the manifold world by mutual relation, which is due to the action of the unifying principle”.

It appears, then, that Green ultimately attributes to God Causality: but endeavours to establish essential difference between Divine and Natural Causality: viz., that the Eternal Consciousness, as unifying principle, has “no separate particularity” apart from the manifold world, “no character but that which it gives itself in ‘its unifying’ action”—although it “must act absolutely from itself in the action through which the world is”. Now I cannot myself conceive these characteristics united: I cannot conceive anything “acting absolutely from itself” and yet having “no character but that which it gives itself in this action”. But, waiving this objection now, I admit that this negation of “character other than that which it gives itself in the action” differentiates the Causality of the Divine Mind profoundly from Natural Causality: but I think it does this at great cost to the system as a whole.

For, first, if God is thus reduced to a mere unifying principle, having no character except that which it gives itself in synthesising the manifold of nature, I do not see how the conception can be made to include the content which the ethical part of Green’s doctrine requires. It is because there is a Divine Consciousness realising or reproducing itself in man, that the true good of man is argued to be not Pleasure, but Virtue or Perfection, and Perfection is held to consist in the realisation of capabilities already realised in the Divine Existence: briefly put, man’s true good is development in the direction of becoming liker to God. But this whole conception implies that God has what Mr. Balfour calls a ‘Preferential Will’ in relation to human life and action; and that his Will is realised in man’s choice of Virtue in a sense in which it is not realised in his choice of sensual pleasure. Well, I do not see how this conception can be maintained if God is also conceived as having no character except that self-given in unifying the manifold of nature: for this unification is surely equally effected in the lives of

¹ *Prolegomena, Metaphysics of Knowledge*, p. 81.

sinner and in the lives of saints, as both are equally capable of being scientifically known. In short, this conception of the relation of God to the world seems to me to constitute a gulf between Green's *Metaphysics* and his *Ethics* which cannot be bridged over.

If, on the other hand, we leave *Ethics* aside, and confine ourselves to the conception of the Divine Spirit regarded as belonging to the *Metaphysics of Knowledge*, it seems to me that this eternal consciousness, characterless apart from its unifying action, is a rather insignificant entity: whose existence is not only difficult to establish logically, but not much worth establishing. The conception, indeed, of the world as a systematic whole, having unity and order through the complex relations of its parts, as well as infinite plurality and diversity; and the conception of the progress of knowledge as consisting in the continual discovery of order, system and unity in what at first presents itself as an almost chaotic diversity—these are conceptions of the highest value. But when they are grasped, what is the further gain to knowledge in referring the unity and system to a unifying principle as its source, if that principle is to have no other character except what it gives itself in its unifying action. Is there any hope that such a conception can in any way help us to *grasp* the unity, the system of relations, more fully and truly? Nay, must not the notion of a Divine Mind, if reduced so far, inevitably dwindle still further, and reveal itself as merely a hypostasised logical element or aspect of the knowable world regarded as a systematic whole?

And this view, I think, will be confirmed by a rigorous examination of Green's main argument for establishing the existence of a spiritual principle in nature. It is the source of the relations that constitute experience a connected whole: but where lies the logical necessity of assuming such a source? Green answers that the existence of the relations involves "the unity of the manifold, the existence of the many in one. . . . But," he says, "a plurality of things cannot of themselves unite in one relation, nor can a single thing of itself bring itself into a multitude of relations . . . there must"—therefore—"be something other than the manifold things themselves which combines them." The argument seems to me unthinkable, because, as Green has emphatically declared, I cannot even conceive the manifold things out of the relations: and therefore I cannot even raise the question whether if I could so conceive them, I should see them to require something other than themselves to bring them into the relations.

But [secondly] Green has another line of argument. He can—he does—appeal to self-consciousness. “The action of our own Mind in knowledge”—he says—gives us a positive conception of the action of the Divine Mind in the universe. Now for myself, in attaining knowledge, I seem to *find* not to *originate* truth. But, granting the human consciousness of “action absolutely from itself” in knowledge, can we infer from this the action of the Universal Mind, consistently with Green’s theory of the human spirit? For if my self-consciousness is to be the *causa cognoscendi* of the causality of the *unifying* principle in the world, that self-consciousness must surely include an indubitable cognition of the essential unity of the self: but in trying to think Green’s conception of the human spirit, I find the notion of its essential unity vanishes. “Our consciousness,” he says, “may mean either of two things; either a function of the animal organism, which is being gradually made a vehicle of the eternal consciousness: or that eternal consciousness itself, as making the animal organism its vehicle.” He then assures us that our consciousness is still “one indivisible reality”: and that the two things just distinguished are merely two aspects of it, the same thing regarded from two different points of view. I cannot think myself thus: I cannot think God as one aspect of me, and my body as another aspect: and it seems to me that, if I did succeed in thinking this, the essential unity of self would have vanished. Green adduces the old simile of the opposite sides of a shield: but it seems to me inapt. For I see clearly that a shield not only *may* but *must* have two opposite sides, united into a continuous surface by the rim: whereas I cannot see how one indivisible self can possibly have as its two sides an animal organism and a self-limiting eternal consciousness.

I have already detained you long, and yet treated too briefly vast topics; but before I conclude, I should like to say a word on the polemical aspect of Green’s Metaphysic. He does not seriously trouble himself with Materialism, and Volitionism does not seem to have come within his ken. Nor, again, is his controversy in the main with Common Sense or Natural Dualism—of which, indeed, his notions are so vague that he speaks of good old Locke as a representative of the “traditional philosophy of Common Sense”. It is rather Sensationalism or Phenomenalism which Green regards as his natural opponent, and to the refutation of which he directs much attention. And yet his attitude towards that element of the knowable world which either of these metaphysical views is disposed to take as ultimate, seems to me somewhat fluctuating and obscure.

He repeatedly speaks of Nature as merely a system of thought-relations, and affirms that "if we exclude from what we have considered real all qualities constituted by relations, we find that none are left"—thus apparently resolve all particular qualities in the manifold of experience entirely into relations. Yet elsewhere he seems to admit that "we cannot reduce the world of experience to a web of relations in which nothing is related": and merely argues against the Sensationalist that in the world of knowable facts there is no such thing as "mere sensation, a matter wholly unformed by intelligence". "A fact consisting in mere feeling is an impossibility."

He is equally willing to admit that there is "no such thing as mere thought": and in fact only to contend that feeling and thought are inseparable and mutually dependent. And he expressly affirms this mutual dependence of thought and feeling, not only in the case of our empirical consciousness, but in the case also of "the world-consciousness of which ours is a limited mode". But if this be so, I do not see how Green is justified—or thinks himself justified—in making the thought element so prominent, and the feeling element so subordinate in his account of Nature: or in speaking of Nature as a system of relations, instead of related feelings; or in resolving—as we saw—the particularity of a feeling entirely into relations. And finally, if "mutual independence of thought and feeling has no place in the world-consciousness," difficult questions arise to which Green suggests no answer. For instance, if any feeling is attributed to the world-consciousness, must not all feeling in the world be so attributed? or how are we to distinguish. Does God then feel the pleasure and the pain of the whole animal kingdom? And if so, is not the ground cut from under the anti-hedonistic positions of Green's Ethics? But I perceive that this topic will introduce so great a wave of discourse—as Plato says—that I must reluctantly abandon it: and apologise for the extent to which I have already tried your patience.

III.—ON THE NOTION OF ORDER.

BY B. RUSSELL.

THE notion of order, although in general neglected by philosophers, has been brought, by modern mathematics, into ever greater prominence. In the theory of number, the whole doctrine of irrationals and of infinity, especially as developed by Cantor, is completely dependent upon order. In Geometry, it has been shown, by the theory of positional manifolds, that the mere possibility of serial arrangement of points, lines and planes suffices for a vast number of theorems. It has been shown also that the essence of projective Geometry lies in the serial arrangement resulting from von Standt's quadrilateral construction—a construction wholly independent of distance and angle. In the whole theory of the Infinitesimal Calculus, and even in the very definition of a function, order has more and more predominated over quantity. But the philosophers have given no thorough analysis of this notion, no adequate discussion of its scope or of its conditions. Indeed, they have in general professed a theory of relations which, if it were correct, would render series logically impossible. It is therefore imperative, in the interests of mathematical philosophy, to supply the defect and to correct the theory. Both will be attempted in the present article.

Before setting forth the conditions which render a series possible, it may be well to point out an important distinction. People are apt to suppose that the order of a set of terms is more or less arbitrary, that we can arrange them as we will, and that there is no intrinsic order among terms. Now it is true that, when a finite number of terms have no intrinsic order, it is possible for us to give them any order we please. But this possibility depends entirely upon the fact that there are sets of terms having intrinsic order, with which any other set of terms can be correlated. A casual collection of terms may be ordered by counting, in which case they are correlated with the integers; by speech, in which case they are correlated with a series of times; or by writing, in which case they are

correlated with a series of places. But the order arises, in each case, from the intrinsic order of the integers, the times, or the places respectively. These have an order independent of our caprice—they form what I shall call *independent* or *self-sufficient* series. The casual terms correlated with them form, on the contrary, only a *series by correlation*. Series by correlation are generated from self-sufficient series as follows: If there be a self-sufficient series A, B, C, D, \dots a collection of terms $\alpha, \beta, \gamma, \delta, \dots$ and a specific relation R which subsists between α and A, β and B, γ and C, δ and D , etc., but not between α and B or C or D or etc. (with similar exclusions for $\beta, \gamma, \delta, \dots$), then $\alpha, \beta, \gamma, \delta, \dots$ acquire, by correlation with A, B, C, D, \dots the order which belongs intrinsically to A, B, C, D, \dots (In general, α may have the relation R to more than one of the terms A, B, C, D, \dots but in this case its position becomes ambiguous.) Thus all orders by correlation are logically dependent upon intrinsic orders. The latter alone will be considered in what follows.¹

Order depends fundamentally upon relations having what mathematicians call *sense*, i.e., such that the relation of A to B is different from that of B to A . Such are east and west, greater and less, before and after, etc. But if order is to arise, another condition is necessary. It must be possible for the same relation with opposite senses to attach to a given term. This excludes such relations as occupation of a place or a time. For though a time may be occupied by an event, there is nothing which the time itself can occupy; and similarly as regards a place. Where both conditions are satisfied, we in general have an order. That is, if there be any relation R , having two senses R_1, R_2 ; and if a term B have the relation R_1 to A , while it has the relation R_2 to C , then B is *between* A and C , and the three terms have the order ABC or CBA . Thus these two conditions are necessary for an intrinsic order of three terms, and become sufficient if we add that BR_1A, BR_2C are to imply the denial of AR_1C .

As relations of the above type will occur constantly throughout the discussion, it will be well to give them a technical name. For this purpose we may divide all relations into four classes, according as they possess or do not possess each of two attributes. Denoting by " ARB " the proposition " A has a certain relation R to B ," ARB may or

¹ The following account of the genesis of order is virtually identical with that of Mr. B. I. Gilman, *MIND*, N. S., vol. i.

may not imply BRA, while ARB and BRC may or may not imply ARC. When ARB implies BRA, I call R a *symmetrical* relation; otherwise, I call R *asymmetrical*. When ARB and BRC imply ARC, I call R *transitive*; ¹ when there is no such implication, I call R *intransitive*. The relations which give rise to series are necessarily asymmetrical, and are also transitive in every particular case known to me, except the doubtful and complex case of genealogy. But we shall find that, provided a series is denumerable in Cantor's sense, ² it is not *a priori* necessary that the generating relation of a series should be transitive. Even where, however, the generating relation is not transitive, it must be such that a given term of the series (with at most two exceptions) has the generating relation to other terms in both senses. It will be seen that relations having sense are either identical with asymmetrical relations, or closely dependent upon them. The only cases where they are not identical are, so far as I know, cases in which the terms of the relation are themselves asymmetrical relations. Here, though A and B have the same relation as B and A, it may happen that their relation is of opposite sense to that of A and B' or A' and B, if A', B' be the opposites of A and B. We shall shortly come across a spatial illustration of this case.

It may be worth while to illustrate the above classification of relations by particular examples. What are commonly called identity and diversity of content, if held to be relations at all, are both symmetrical, the first being also transitive, while the second is intransitive. Other symmetrical transitive relations are equality, simultaneity, brotherhood (when taken to include sisterhood). All these, it should be observed, are reducible, as may be proved in each particular case, to possession of a common property, or identity of content. This again, on examination, is found to consist of sameness of relation to the so-called common property ³; but this remark is a digression. Most symmetrical intransitive relations seem reducible to diversity, and all symmetrical transitive relations seem reducible to identity. Asymmetrical relations, on the contrary, are of many irreducible types, and show very important differences according as they are transitive or intransitive. It should be observed that it is

¹ This term was used in this sense by De Morgan, e.g., *Camb. Phil. Trans.*, ix., p. 104, and x., p. 346. It is now generally adopted.

² I.e., provided it either has a finite number of terms, or is such that any assigned term is the *n*th, if *n* be a suitably chosen finite number.

³ Cf. De Morgan, *Camb. Phil. Trans.*, x., p. 345.

formally impossible to reduce asymmetrical relations to identity or diversity, since these are both symmetrical. Examples of asymmetrical transitive relations are: greater and less (both in number and quantity), whole and part, logical priority and posteriority, before and after, the two directions on a straight line. Examples of asymmetrical intransitive relations are: occupation of a place or a time, the relation of goodness, truth or beauty to what is good, true or beautiful, the relation of being and existence to entities and existents.

We can now see how order arises among a collection of terms. If it is assumed that there are no ultimate symmetrical transitive relations, such relations being always reducible to identity of relation to some other term, then there remain two principal ways in which order may be generated.¹ Of these the first has the advantage of applying to continuous series, while the second has the advantage of allowing periodic or cyclic series. These two ways are as follows:—

(1) Let there be a collection of terms $A, B, C, D \dots$ and an asymmetrical relation, whose two senses R_1 and R_2 are both transitive. Let this relation subsist between every pair of terms of the collection, so that, if F and K be the two terms, we have either FR_1K or FR_2K , and either KR_2F or KR_1F . Then all the terms of the collection have an unambiguous order. For, with respect to any term F , all the other terms fall into two classes, those having to F the relation R_1 , and those having to F the relation R_2 . Let K belong to the latter class, so that KR_2F and FR_1K . Then with respect to F and K , all other terms fall into three classes: (α) Terms A for which AR_1F, AR_1K ; (β) terms H for which HR_2F, HR_1K ; (γ) terms N for which NR_2F, NR_2K . (The case $\Omega R_1F, \Omega R_2K$ is excluded by the transitivity of R_1 and R_2 . For ΩR_1F and FR_1K imply ΩR_1K , which is inconsistent with ΩR_2K , and therefore there is no such term as Ω .) Of these three classes, the first is said to be before (or after) F and K , the second to be between F and K , the third to be after (or before) F and K . Thus all terms of the series have an unambiguous order with respect to F and K , and therefore (since F and K are arbitrary) with respect to any two terms of the series.² When there are no

¹There are four other ways, of less philosophical importance; but all of these, as well as the second, may be mathematically reduced to the first, which is alone fundamental. For the most important of the other four, see Vailati, *Rivista di Matematica*, vol. v., pp. 76, 188.

²This method is that given by Vivanti, *Formulaire de Mathématiques*, vol. i. (Turin, 1896), vi., § 2, No. 8.

terms in class (β), F and K are said to be consecutive; when there are none in class (α), F is said to be the first (last) term of the series; when there are none in class (γ), K is said to be the last (first) term.

(2) In the second way of generating order,¹ the generating relation is still asymmetrical, so that it has two senses R_1 , R_2 , but these are both intransitive. Here every term of the collection (with the exception of one or two) has the relation R_1 to one term, and the relation R_2 to one other term. There may be one term which has no relation R_1 , and there may be one which has no relation R_2 . But no term is to have more than one relation R_1 and one relation R_2 to other terms of the series. If F be any term of the series, having the relations FR_2E , FR_1G , we say that F is between E and G and consecutive to them. F is before one of them (say G) and after the other. A term A which has no relation R_2 is called the first term, and a term Z which has no relation R_1 is called the last term. If E is before F, and F before G, E is said to be before G. Thus every term has a definite position in the series. But this method is only applicable where series have consecutive terms, which is not the case with continuous series, such as points, instants, or the real numbers. On the other hand, since R_1 and R_2 are intransitive, this method allows, while the former method in general does not, a cyclic or closed series. For it may happen that, when we reach a certain term Z, proceeding by relations R_1 , we find that ZR_1A , A being one of the terms we already had. In this case, the whole series repeats itself. When a series is thus closed, the notion of *between*, or of *before* and *after*, must not be extended from consecutive terms to others. If AR_1B and BR_1C , we may still say that B is between A and C. But if further CR_1D , we must not on that account say that B is between A and D. For we may have DR_1A , and thus D will be also between B and A. In order to obtain an unambiguous serial notion applicable to terms which are not consecutive, we now need four terms, as A, B, C, D. Two terms A, C which are not consecutive divide the remaining terms into two classes, these obtained in proceeding from A to C by relations R_1 , and these obtained in proceeding from A to C by relations R_2 . If B belongs to the first of these classes, while D belongs to the second, B and D are separated by A and C, *i.e.*, any passage from B to D must take either

¹This is the only method given by Bolzano, *Paradozien des Unendlichen*, 1850 (§ 7).

A or C on the way. Similarly A and C are separated by B and D.¹ Thus this symmetrical relation of four terms replaces, in a cyclic order, except where three terms are consecutive, the simpler relation of *between* which is applicable to open series.

It should be observed that, if symmetrical relations be allowed as ultimate, there is a third way of generating order, according to which, even in an independent series, it is possible for two or more terms to occupy the same position. This method will have to be adopted by all who deny absolute time, since they will have to admit simultaneity as a direct relation between events. It is as follows: Let a collection of terms $A_1 A_2 A_3 \dots B_1 B_2 B_3 \dots C_1 C_2 C_3 \dots$ be such that any two have either a symmetrical relation R or an asymmetrical transitive relation whose two senses are R_1, R_2 . Assume further that $A_1 R A_2, A_2 R_1 B_1$ imply $A_1 R_1 B_1$, and $C_1 R C_2, C_2 R_2 B_1$ imply $C_1 R_2 B_1$. Then any two terms which have the relation R are said to have the same position; if one has to another the relation R_1 , it is before (after) the other, and the other is after (before) the one. Let all the A's have to one another the relation R, and likewise all the B's, all the C's, etc., while any A has to any B the relation R_1 , and so on. In this way again an unambiguous order arises. But it is evident that this case might appear to arise if all the A's had a certain relation R' to a certain term α , while the B's had the same relation to a term β , and so on, the terms $\alpha, \beta, \gamma \dots$ forming a series of one of the two former kinds. In this way the necessity for admitting ultimate symmetrical relations is overcome: $\alpha, \beta, \gamma \dots$ are the positions of the A's, B's, C's \dots respectively, and the independent order is that of the positions, while that of the A's, B's, C's \dots is only an order by correlation. The legitimacy of this reduction is, in some cases, a question of first-rate philosophical importance (especially as regards space and time), but I shall not argue it here. My future remarks are to be understood as not applying to series of this third type, if any such there be.

The consideration of logical order—for example the order of Euclid's propositions—suggests a fourth very peculiar way of generating series. Logical order depends upon the relation of implication, but is rendered peculiar by the fact that implication is sometimes symmetrical and sometimes

¹ This four-term relation of separation may be taken as independent, and used to generate a series if our collection of terms having the relation of separation contains at least five terms. See Vailati, *loc. cit.*

asymmetrical. Thus the axioms, in Euclid, together (but not separately) imply the fourth proposition, while this proposition implies some but not all of the axioms required in its proof.¹ The fourth proposition implies the fifth, but the fifth does not imply the fourth. The fifth implies the sixth, and the sixth, together with the axiom of parallels and an axiom of continuity, implies the fifth. The fifth implies the seventh, but the seventh does not imply the fifth. The seventh and eighth have a clear mutual implication, but the seventh is prior, because, unlike the eighth, it is directly implied by the previous propositions. This analysis of implications might be carried further. But what is already evident is this, that a series may, in a way analogous to the second method above explained, be generated by intransitive *symmetrical* relations. If ARB and BRA , BRC and CRB , etc., while no term has more than two relations R , and two terms at most have less than two (*i.e.*, one) such relation, then B is between A and C , C between B and D , and so on. This method again is only applicable to denumerable series. It may be held that, if none of the relations are asymmetrical, we cannot properly speak of an order, since the series has not two distinguishable senses. But if the relation R is sometimes, or even once, asymmetrical, then the series has two senses. In the case of logical order, this is the case. Euclid's fourth proposition implies his fifth, but his fifth does not imply his fourth. Thus if there be a term a for which aRA , but not ARA , we have a reason for putting a at one end of the series, and pursuing the order $aABC \dots$ or $\dots CBAa$. If further there is no term a' for which $a'Ra$, the reason for putting a at one end is reinforced. This is the position which the axioms are supposed to hold. If there is no term β for which $ZR\beta$ but not βRZ , *i.e.*, if the series has no other end besides a , then a must be put at the beginning. (The order beginning with β is, however, well illustrated in Hobbes' astonished regress from the forty-seventh proposition to the axioms.) In Euclid, R is sometimes symmetrical, sometimes not; terms for which it is not so occur at various points in the series of propositions. This method has, so far as I know, no exemplification except logical order; and as logical order is a very obscure notion, it seems scarcely legitimate to assume that such a method does ever really arise. It deserves to be borne in mind, but can hardly be considered as more than a

¹ The axioms explicitly enumerated by Euclid are grossly insufficient for the proof in question.

suggestion; for a relation which is sometimes symmetrical and sometimes asymmetrical seems intolerable, and should be avoided if possible.¹ I shall therefore say no more of this method in what follows.

It is quite necessary to order that, if BR_2A and BR_1C , R_1 and R_2 should be such that these two propositions together imply the denial of AR_2C and CR_1A . This may be made plain by considering an extremely peculiar relation, which, though it has sense, is yet symmetrical. The relation I mean is that of right or left. Right and left are relations between directed straight lines which do not intersect; any two such lines (which will be called rays, to distinguish them from lines without direction) have one or other of these two relations. For example, with relation to the upward vertical, a line from north to east is one from left to right; with relation to the downward vertical, the same line is from right to left. Thus if A, B be any two non-intersecting rays, and A', B' their opposites, denoting by AB the relation between the rays, we have—

$$AB = BA = -AB' = -A'B'.$$

This relation does not allow us to form series of lines, because it is not transitive (i.e., if AB and BC be right-handed, it does not follow that AC is right-handed), and because, what is more, the relation AC may be the opposite of AB and BC (i.e., when these are right-handed, AC may be left-handed). This relation also is the only one known to me which is symmetrical and yet has sense. It is probably capable of analysis, but I have not succeeded in analysing it. In spite of its importance to Kant's philosophy, it has received practically no attention from philosophers.

¹ A little subtlety is required to avoid confusion in this respect. A relation is not symmetrical merely because ARB and BRA coexist, but only if ARB implies BRA . Thus the fifth and sixth propositions of Euclid afford a case of mutual implication: for the fifth states: A triangle is isosceles (A) implies that it has equal angles at the base (B); while the sixth states the converse, B implies A , and shows in the course of the proof that this is implied by the fifth, i.e., by A implies B . But even here there is asymmetry at last: for though A implies B implies B implies A , yet B implies A does not, without the help of other axioms, imply A implies B . It is plain that this process of complicating implications may be continued *ad infinitum*, and that asymmetry may appear at any stage. The complication is due to the fact that the relation in question, that of implication, is itself used in the definition of symmetrical and asymmetrical relations. A case of perfect symmetry of mutual implication seems to be afforded by AR_1B and BR_2A , where R_1, R_2 are the two senses of any asymmetrical relation.

Summing up the above account of the genesis of order, we may say—and this covers both ways of generating series—that order is essentially a relation of three terms A, B, C, consisting in the fact that one of them, B, has to the other two, A and C, asymmetrical relations which differ only in sense, while A does not have to C the same relation, with the same sense, that B has to A, nor yet does C have to A the same relation, with the same sense, that B has to C. What the relations to A and C are, is quite irrelevant, so long as they are asymmetrical and differ in sense. What is fundamental is this relation between the two relations, not any direct relation of the three terms A, B, C; for it sometimes happens (*e.g.*, in the series of rational fractions) that one and the same collection of terms has two intrinsic orders, so that, according to the order chosen, B may be between A and C, or A between B and C. This shows that *between* is not a direct relation of the three terms A, B, C. Thus difference of sense—which is the general logical idea underlying difference of sign in Mathematics—is here the fundamental conception. Let us now examine its nature, and the theory of relations which its recognition entails.

It is customary to regard relations as reducible to or as implying adjectives of the related terms. This is involved in Lotze's contention that relations are really internal states of things, and in Mr. Bradley's dogma that no relations are purely "external". Many abstract arguments may be urged against this view, but the consideration of difference of sense makes its inadequacy peculiarly evident. This may be shown by the following quotation from Leibniz:—

"The ratio or proportion between two lines L and M may be conceived three several ways; as a ratio of the greater L to the lesser M; as a ratio of the lesser M to the greater L; and lastly, as something abstracted from both, that is, as the ratio between L and M, without considering which is the antecedent, and which the consequent; which the subject, and which the object. . . . In the first way of considering them, L the greater is the subject, in the second, M the lesser is the subject, of that accident which philosophers call *relation*. But which of them will be the subject in the third way of considering them? It cannot be said that both of them, L and M together, are the subject of such an accident; for if so, we should have an accident in two subjects, with one leg in one, and the other in the other; which is contrary to the notion of accidents. Therefore we must say that this relation, in this third way of considering it, is indeed *out of* the subjects; but being neither a substance, nor an accident,

it must be a mere ideal thing, the consideration of which is nevertheless useful."¹

Leibniz adopts, in this passage, the theory of relations which has remained orthodox from his day to our own. That relations must be reduced to accidents is a position which, as is evident, he regards as not open to question. Nevertheless the necessity of relations not so reducible is rendered peculiarly evident by the lucidity of his analysis. His position may be stated as follows: When there is an asymmetrical relation R between two terms A and B , this is equivalent to an adjective β attaching to A , and an adjective α attaching to B . The abstract relation R has no being except in a mind contemplating A and B . But the inadequacy of this account is evident when we consider that α involves reference to A , and β involves reference to B . If, as in Leibniz's instance, A and B are two magnitudes of which A is the greater, then α is "less than A ," and β is "greater than B ". But these are not simply adjectives of their terms: they are analysable, respectively, into *less* and *A*, *greater* and B . Thus the abstract relations *less* and *greater* remain necessary, and instead of having, in α and β , mere adjectives of B and A , we have in each relations to A and B respectively. Thus the relational form of proposition must be admitted as ultimate: *greater* and *less* must be regarded as two distinct relations, of which it is significant and true to say that, if one holds between A and B , then the other holds between B and A . A is not intrinsically greater, nor B intrinsically less: A will (in general) be less than some magnitudes, and B greater than some others. Thus unless relations be admitted as ultimate, we arrive at a definite contradiction, namely this: An asymmetrical relation shows some difference between A and B , and yet, when either is considered alone, nothing can be found in it which would not be found also in the other considered alone. In short, the two have no difference of adjective, but only the immediate difference which consists in the fact that they are diverse terms.

This argument may be put generally as follows. Let two terms A and B have an asymmetrical relation R , which is to be expressed (if possible) by the adjectives β and α , where β has a reference to B , and α to A . Neither α nor β can be expressed without this reference, and they differ in content, not only by referring to A and B respectively, but also by having different senses. A and B , considered without refer-

¹ Fifth Paper against Clarke, No. 47; Gerhardt's ed., vol. vii., p. 401.

ence to R, have no difference of content corresponding to α and β , though either α or β alone may be considered as expressing a difference between A and B. In fact, α gives to B the adjective of differing from A in a certain manner, while β expresses the same difference with A as starting point. We have thus a difference between A and B, namely that expressed by α or β , but we have no corresponding point of difference. We cannot use the difference between α and β to supply the point of difference, for both state a difference, and therefore, on the traditional logic, presuppose a point of difference. We must, in fact, have a difference between A and B, without any corresponding point in which they differ, or, as it may be put, a conception of difference without a difference of conception. Only when relations are accepted as ultimate, and allowed to be what is called "external," does this cease to be a contradiction.¹

If we adopt what may be called the monistic theory of relations, and say that they give really an adjective of the whole composed of the related terms, we become liable to an analogous difficulty. For the whole composed of A and B is primarily symmetrical, yet it will have to have a different adjective when A is greater than B from that which it has when B is greater than A. This will require us to distinguish the whole (A, B) from the whole (B, A), which demands an asymmetrical relation between the parts, which was just what we wished to avoid.

We thus see that the difference of sense, or, speaking generally, of sign, is a fundamental and unanalysable logical fact, which is the source of order and series. Some, if not all, relations, other than diversity, are such that, if one of them holds between A and B, then it is not the same relation, but a correlative one, that holds between B and A. It is plain that, if A is related to B, B is also related to A; hence, if B does not have to A the same relation that A has to B, then B must have a relation to A which is correlative to that of A to B. The difference between these correlative relations is the difference of sense.

It is a question of considerable importance in Logic, and particularly in the theory of inference, whether, in cases of difference of sense, we are to speak of one relation with two senses, or of two distinct relations with the relation of

¹ See "The Relations of Number and Quantity," *MIND*, N. S., No. 23, written while I still accepted the current theory of relations, which I was led to abandon by Mr. G. E. Moore. See his article on "The Nature of Judgment," *MIND*, N. S., No. 30.

difference of sense. For example, is "A is greater than B" a different proposition from "B is less than A," or do the two only differ grammatically? When we consider these two propositions as wholes, there is much appearance of identity: it seems as though one and the same fact were expressed by both. Nevertheless, when we analyze them, *greater* obviously differs from *less*; thus the two propositions seem to be composed of different constituents, and therefore to be necessarily distinct. To deny that they are distinct, it would be necessary to hold that both *greater* and *less* enter into each proposition, which seems obviously false, or else to hold that what really occurs is neither of the two, but that third abstract relation of which Leibniz speaks in the passage quoted above. In this case, the difference between *greater* and *less* would be one involving reference to the terms A and B. But this view cannot be maintained without circularity: for neither the *greater* nor the *less* is inherently the antecedent, and we can only say that, when the *greater* is the antecedent, the relation is *greater*, when the *less*, *less*. Thus it seems absolutely necessary to regard *greater* and *less* as distinct relations, and to hold the same of pairs of asymmetrical relations R_1, R_2 generally. We must then say simply that AR_1B implies BR_2A , and is inconsistent with AR_2B and BR_1A . These implications are subsequent to the fundamental fact that R_1, R_2 have that kind of relation which is called difference of sense. f

Two ideas of a general kind must now be explained, of which one belongs necessarily to all series, while the other, though not necessary to series, belongs to a large class of series, and in particular to all series of magnitudes. These two may be called *length* and *distance*, provided it is understood that these words are to have no spatial implication. Instead of *length*, however, it may be better to employ the word *stretch* (*Strecke*), since this word does not suggest space quite so irresistibly as *length* does.¹

If A and N be two terms in a series, the stretch from A to N consists of all the intermediate terms B, C, . . . M. (For certain purposes, it is convenient to define the stretch as containing also *one* of the end-terms, say N.) Thus the stretch is an assemblage of terms, which, in continuous series, is always infinite. Wherever there is a series, the stretch is definite in the sense that any suggested term of the series can be seen to belong or not to belong to the stretch as the

¹ On the distinction of stretch and distance, see Meinong, *Ueber die Bedeutung des Weber'schen Gesetzes*, Hamburg, 1896; e.g., p. 22.

case may be. But in cyclic series, it is necessary to fix not only the end-terms, but also the sense in which we are to pass from the one to the other, since every pair of terms defines two stretches. The stretch is a whole consisting of many terms, and where there is a finite number of terms, it is measured by counting this number. (For this purpose, one of the end-terms should be included, since then the number of terms in the stretch may be taken as the measure of the distance.)

Distance arises wherever the generating relations of the series are a kind of magnitude. In this case, if R_1, R_2 be as before the generating relations, any two terms A and N have not merely the abstract relations R_1, R_2 , but also particular amounts of these relations. In time, for example, one moment is not merely after another, but is also more or less after. In any class of magnitudes, one magnitude is not merely greater than another, but is also more or less greater. And generally, in most particular cases of series, if AR_1B and BR_1C , we have not only AR_1C , but also the relation of A to C is a greater amount of R_1 than the relation of A to B or of B to C . In all such cases, the particular amount of R_1 or R_2 which expresses the relation of A to B is called the distance from A to B , and amounts of R_1 and R_2 are magnitudes differing in sign. It is not strictly necessary, as we saw in discussing the genesis of series, that R_1 and R_2 should be kinds of magnitude. But when this is the case, new inferences are possible. If AR_1B and AR_1C , it was formerly impossible to infer anything as to the relation of B to C . But now we know, denoting by R_{AB} the distance between A and B , that if R_{AB} is greater than R_{AC} , then CR_1B ; if less, then BR_1C . And generally, if two terms have distances in the same sense from a given term, the one which has the smaller distance is between the other two. It is important to observe that the difference of two magnitudes of the same kind is always a magnitude, so that the series formed of any class of magnitudes is always one in which we have distance. But the difference is not in general (indeed, strictly, is not ever) a magnitude of the same kind as those whose difference it is. The excess of one pleasure or temperature over another is not a pleasure or a temperature, but a new species of magnitude; and in strictness this is also true of the difference of spatial or temporal distances. But the difference is, in all such cases, what we have defined as a distance. A distance is, in fact, the magnitude of the relation of two terms in a series, whenever this relation has a magnitude—whenever, that is,

the generating relations of the series are species of magnitude.¹

It may happen that a collection of terms is such that any two of the terms have a relation which is a magnitude, and that, by this means, the terms can be arranged in a series, according as their relation to a given term is greater or less, while yet the relation is symmetrical, and is therefore not of the nature of a distance in the above sense. We shall find that in space, if there be such a relation as distance, this case is exemplified—distance in space, if it exists, must be a symmetrical relation. This case must be carefully distinguished from that of distance in a self-sufficient series. For where the relation is symmetrical, the magnitudes of the relation form the only self-sufficient series, while the terms of the relation form only a series by correlation. Where, on the other hand, there are distances which are asymmetrical, the terms between which the distances hold are a self-sufficient series, as well as the distances themselves. Thus the two cases are quite distinct, and must on no account be confused.

The preceding remarks have, in general, been only applicable to open series, *i.e.*, such as either have one or two ends, or, if endless, do not lead back by successive forward steps to any previous terms. Some remarks on cyclic order seem called for, since the lines in a plane through a point, the planes through a line, and, in finite spaces, the points of a line, form cyclic series. We have already seen that there is no difficulty about such series when they are discrete, since they can be generated in the second manner. But when they are continuous, in the sense of not being denumerable, they have no consecutive terms, and therefore the second method is inapplicable. Cyclic series may easily arise by correlation: for example, $\sin x$ is a cyclic series, though x be an open series. But for Geometry, it is important to discover whether an independent continuous cyclic series is possible. The following method seems to render such a series formally possible, though by a very artificial device: Let the series be one in which we have

¹ It should be observed that there can never be distances in series generated in the second manner, *i.e.*, by relations between consecutive terms only, except by reducing them to series of the first kind—a reduction which, being largely mathematical, cannot be given here. But there are comparatively few instances of series so generated. It is often supposed that causal relations hold only between consecutive events, but this opinion can be formally refuted by considering the continuity of time, in virtue of which there are no consecutive events.

distance, but let no two terms have a distance greater than a certain maximum, M_1 or M_2 according to the sense. Nevertheless, if AM_1B , let there be terms C for which BR_1C , R_1 being a distance in the sense of M_1 . Then if distance were always transitive, we should have $AR_1'C$, where $R_1' > M_1$. Thus to exclude this case, we must hold distance to be only transitive so long as its transitivity does not introduce a distance greater than M_1 or M_2 . When such a distance would be introduced, the actual distance is to have the opposite sense, so that, in the above case, instead of $AR_1'C$, we have $AR_2''C$. Then our series will be closed. But the assumptions required are plainly very complicated.

A somewhat less artificial scheme is possible in the case (which is that of directed lines in a plane through a point) where the series itself consists of asymmetrical relations, relations differing in sense occurring in antipodal positions. Thus suppose we have relations $A, B, C, D \dots A, B', C', D', \dots$ A' being the opposite of A , and suppose a relation of the kind required for series to subsist between any two of these relations. If we then assume further that AR_1B implies BR_1A' , while CR_2A implies AR_2C' , we have pairs of terms naturally marked out as antipodal, and the above account becomes far less artificial. Thus AR_1B and BR_1C coexist with AR_1C , so long as CR_1A' ; and so long as this is the case, the stretch from A to C is less than that from A to A' . But if CR_2A' , then AR_1B and BR_1C coexist with AR_2C . If AR_1B , BR_1C , CR_1A' , we may still say that B is between A and C ; but if CR_2A' , no one of A, B, C is between the other two. In order to get a relation of order which holds whatever terms we choose, it is necessary to take the relation of four terms already alluded to, which consists in the fact that, of any four terms in a closed series, two are separated by the other two. In our present case, A, A' are always separated by B, B' . As a symbol for this order, we may adopt $ABA'B'$. In open series, we have the fundamental proposition: If B is between A and C , and C is between B and D , then B and C are between A and D . In closed series, this is replaced by: $ABCD$ and $ACDE$ imply $ABCE$.

It appears from Vailati's work (quoted above) that these four-term relations may be taken as fundamental, and that every series may be taken as open or closed as we like. The only philosophical distinction between open and closed series is the distinction between the case where relations of two or three terms are logically prior, and the case (which

occurs, e.g., in projective Geometry) where the four-term relation is the logically prior.¹

I shall now apply the foregoing general remarks to various special series. Let us begin with the order of numbers, as being one of the most fundamental.

(1) *Numbers.* That numbers form an independent series, will probably be allowed by those who hold that arithmetical propositions are synthetic. If integers are held to form only a series by correlation, this must be because they are regarded as ordered by successive additions of units. But this view depends upon a false analysis of addition. Addition does not apply to numbers as such, but to terms of any kind. $1 + 1 = 2$ is not a proposition as to the pure numbers 1 and 2, for there is only one number 1, and to take it twice over would, as in the Logical Calculus, only yield 1 over again. $1 + 1 = 2$ means "one term and one term are two terms," or "A is one and B is one together imply A and B are two." But here the nature of A and B is quite irrelevant, and it seems plain that some relation between the pure numbers 1 and 2 must be implied by so complex a proposition. If there be such a relation, it is evident that it must be asymmetrical. Whether we hold that this relation is only between consecutive numbers, or is between any pair of numbers, it will in either case give rise to an order among integers. Such a relation seems to be found in ratio, provided we strip ratio of its numerical measurement by fractions, and regard it as an intensive magnitude, giving an immediate and indefinable relation between two integers. Since any two integers have a ratio, we shall regard our series as generated in the first manner; and since one ratio is greater or less than another, a ratio is of the nature of a distance. Its numerical measurement, like that of all intensive magnitudes, is in part conventional; but it is interesting to observe that the best measure is not the fraction formed by the two integers, but the logarithm of this fraction.² This may be made plain by considering the following general desiderata in numbers which are to be co-ordinates of distances:—

(1) The distance of a term from itself is zero; therefore the number which is the co-ordinate of this distance should be zero.

(2) Equal distances should be represented by the same number.

¹ See Pieri, *I Principii della Geometria di Posizione*, Turin, 1898; esp. § 7.

² Cf. Leibniz, Fifth Paper against Clarke, No. 54.

(3) Distance $AB = -$ distance BA ; therefore the co-ordinates of these two distances should be equal and opposite numbers.

(4) The numbers representing distances should be additive, so that, if ab, bc, ac be the co-ordinates of AB, BC, AC respectively, then $ab + bc = ac$.¹

All these conditions are satisfied by $\log m/n$, if m, n be the two numbers whose distance is to be measured. All except the second are satisfied by $(m - n)$. But having agreed that ratio is prior to addition, that "2 is twice 1" is prior to $1 + 1 = 2$, we cannot take distances to be measured by the differences of numbers. If we have once agreed that ratio is the fundamental relation between numbers, then, since equal ratios correspond to equal fractions, we must measure distance by some function of the fraction, and then the logarithm is the only function which is additive. The advantage of the logarithm over the difference may be reinforced, as Meinong points out, by the consideration that the distance between 0 and any finite number is greater than that of any two finite numbers. This distance should, therefore, be represented by a number greater than any finite number—a condition which the difference does not satisfy.²

(2) *Whole and Part.* The relation of a whole to any one of its parts is a specific simple relation, correlative to that of part to whole. These two relations are asymmetrical and transitive, and are of the kind which generates series. It may be doubted whether these relations have magnitude, and whether, consequently, they are of the nature of distances. However this may be, it is certain that wholes have more or less complexity or divisibility. In finite wholes, *i.e.*, such as have a finite number of indivisible parts, the divisibility is measured by the number of simple parts, *i.e.*, two wholes having the same number of simple parts have the same divisibility, and one having more simple parts has more divisibility. But where there is not a finite number of simple parts, as with spaces and times, the series of colours of the rainbow, or the stretch of fractions between

¹ Cf. Meinong, *op. cit.*, section iv.

² It should be observed, however, that all Arithmetic can be successfully deduced if we regard our series of integers as generated in the second manner, by relations which only hold between consecutive integers. This method is best set forth by Peano, *e.g.*, *Formulaire de Mathématiques*, vol. ii., § 2 (Turin, 1898). The decision between the two methods is mathematically unimportant; philosophically, it seems only possible by immediate inspection.

0 and 1, the divisibility cannot be thus measured. There is some reason to regard divisibility as a relation of the whole to its simple parts, since the divisibility of a simple term is zero, not unity, as it would be if it were represented strictly by the number of simple terms composing the whole. Thus divisibility may be regarded as of the nature of a distance.

(3) *Magnitudes.* Every species of magnitude forms a series, in which the generating relations are *greater* and *less*. It should be observed that equality is not a relation between magnitudes, or even strictly a relation at all. Two terms which have the *same* magnitude are called equal: the terms themselves are not magnitudes, but complexes into both of which the same magnitude enters as an element. Thus two yards have the same magnitude, *i.e.*, the distance in the two is not equal, but identical; what is different is the points which have the distance in the two cases. The order of magnitudes is specially fundamental, because, as we have seen, the terms of most if not all series have distances which are magnitudes. Another reason which makes the order of magnitudes interesting is, that all the terms in such an order have distances which in general are magnitudes of a new kind; these distances in turn have an order, and have new distances; and so on *ad infinitum*. It is only the practice of numerical measurement, and of representing distances of magnitudes by the differences of their numerical measures, that has obscured the fact that the distance of two magnitudes is a magnitude of a new kind. It may be doubted, however, whether this is always the case. If there be an exception, it would seem to be in the case of ratio; for it may be held that the distance of two ratios is again a ratio. But however this may be, it must on no account be supposed that the ratio of two integers is ever an integer. The ratio of 2 to 1, for example, is the relation *twice*, which is radically distinct from 2. No integer is a relation, but every ratio is a relation. And it is only thus that our fundamental proposition "2 is twice 1" remains significant, and escapes the condemnation pronounced on $1 + 1 = 2$.

(4) *Time.* No difficulties, in regard to our present problem, are offered by time. The generating relations are *before* and *after*, which hold between every pair of instants and are transitive and quantitative. (For we may certainly have more or less priority or posteriority.) Grave difficulties would arise if we were to regard the time-series as primarily one of events; but when it is recognised that events only acquire an order by correlation with the times they occupy,

no difficulties emerge. In relation to time, the distinction between distance and stretch becomes important: the distance from a moment A to a moment B is a certain magnitude of priority or posteriority, which is relational and indivisible; the stretch from A to B consists of all the moments between A and B. It will be seen that the stretch presupposes the time-order, while the distance is prior to it, being one of the generating relations of the order. The only thing about the distance that is not essential to order is the fact that the distance is a magnitude. Relational theories of time hold that the distance alone is temporal, while the stretch consists of events, as do the end-terms A and B of the distance. Absolute theories, on the other hand, hold that the stretch consists of moments. It may be observed that, by the distinction between distance and stretch, it is possible to give a meaning to holes in space or time. It is often said that these are impossible, but we are not often told what it is whose impossibility is asserted. Without the distinction of distance and stretch, a hole can only be a period when there is no time or a place where there is no space, both of which are self-contradictory. But with the distinction, a meaning can be found for holes. There would be a hole in time if there were two moments having no others between them, but yet having a finite distance, *i.e.*, a distance equal to that of two moments which have innumerable others between them. A similar definition applies to space. Thus the denial of holes amounts to the assertion, which is distinctly synthetic, that any two points or moments have others between them, or that finite distances always correspond to finite stretches. (It should be noted that, in continuous series, a finite stretch consists of an infinite collection of terms.)

(5) *Space*. The case of space is interesting and peculiar. For although we might seem to have distance in space, yet it is not by means of distance that the points of a straight line are ordered. They are ordered by means of a relation destitute of magnitude, namely, what I call *direction*.¹ Between every pair of points there are, we may suppose, two relations, distance and direction.² Distance, if there be such a relation, is a magnitude, but is a symmetrical relation without sense. Direction is not a magnitude, but is asymmetrical and has sense. (I use direction, not in the

¹ See *Revue de Métaphysique et de Morale*, t. vii., p. 704.

² We shall shortly see reason to doubt whether there is any such relation as distance at all.

sense of elementary Euclidean Geometry, in which parallels have the same direction, but in the sense applicable also in non-Euclidean Geometry, in which no two straight lines have the same direction, but two directions are associated with every line.) These two assertions may be proved as follows: (1) Distances may be equal though on different straight lines; but when they are on different straight lines, this difference cannot be represented by difference of sign. Hence it follows that distances are independent of their straight lines, and that the distances AB , BA (when distance alone is considered) are equal, and do not differ in sign. For example, a sphere may be defined as the locus of points having a given distance from a given point. If there be such a relation as distance, no reference to the straight line is involved in this definition, and points at opposite ends of a diameter have the *same* distance from the centre, not distances differing in sign. Hence distance is a magnitude without sign, and is therefore not an asymmetrical relation. Again, distance alone does not suffice for the ordering of points, since, so far as distance is concerned, all the points of a sphere have the same position relatively to the centre. (2) But the points on a straight line evidently have an order, and it is also evident that the direction AB differs from the direction BA . Hence direction is an asymmetrical relation, though not a magnitude. The points of a straight line, except in finite spaces, may be ordered by means of direction alone, in the first manner explained above. For if AB , BC have the same sense, or if \overline{BA} , \overline{BC} have opposite senses, B is between A and C ; and hence the order is definite.¹ It should be observed that projective Geometry takes the straight line more abstractly, *i.e.*, in what Leibniz in the above quotation calls the third way of considering the relation, in which no regard is had to sense. In projective Geometry, AB and BA are the same straight line, and are not distinguished as opposite directions. Hence, so long as our theorems are purely projective, they do not allow us to assume that the points of a line have an order. A certain order is *proved*, by means of the quadrilateral construction; but this order is distinct from the elementary order resulting from direction.

Thus by means of direction alone, without any appeal to distance, we have shown that the points of a straight line have an intrinsic order, and form a self-sufficient series. Is

¹ In elliptic spaces, the straight line is finite: hence AB has either sense, and the above method fails.

there now any reason for recognising distance as an independent relation at all? This may be legitimately doubted, for, having ordered our points, we now have perfectly definite stretches. We may replace distances by stretches, and compare stretches along different lines. There seems no imperative reason for distances. If it be said that stretches, being infinitely complex, could not be quantitatively compared unless they corresponded to distances, the reply is, that areas and volumes have undoubtedly the same complexity that stretches have, and are yet capable of quantitative comparison. There seems thus no way of deciding the question except immediate inspection; and I confess that, from my own inspection, I am unable to pronounce in favour of either alternative. If, however, we are unwilling to admit symmetrical relations, it becomes necessary to deny distance and admit stretches only.

The series of lines in a plane through a point, and of planes through a line, are probably not independent, since they may be obtained by correlation with the points of a line.¹ Thus the only self-sufficient series of spatial terms, if the above theory be correct, are those formed of the points on straight lines.

If, however, it be held that the lines in a plane through a point do form a self-sufficient series, then they are an instance of the method explained above for generating continuous closed series. Taking straight lines as having direction, in which sense I shall call them rays (so that two rays are associated with every straight line), the angle between two rays is unambiguous. Each ray is an asymmetrical relation, and rays are ordered by the relations of right and left, which are transitive so long as the opposite to the first ray is not passed. It may be observed that this method affords a general interpretation of $\sqrt{-1}$ not essentially dependent upon Geometry. If a series be formed of pairs of asymmetrical relations, and contain distances, then if R_1 be such a distance that, for some pair of terms A, B , we have AR_1B and BR_1A' , where A' is the opposite of A , then $R_1 = \sqrt{-1}$; for, by the very nature of difference of sign, $A = -A'$. We find also that the correlated distance R_2 is the other square root of -1 , for we have $A'R_2B$ and BR_2A , and $A' = -A$. Although this abstract account seems incapable of exemplification except in Geometry, yet it is logically quite independent of space, and depends solely upon the possibility of such series of asymmetrical relations.

¹ Cf. *Revue de Métaphysique et de Morale*, t. vii., p. 705.

In addition to the series above discussed, there are a few others which seem to be independent. Such are the colours of the rainbow, and sounds of various pitch. (Loudness is included among magnitudes.) Thus the number of kinds of independent series other than magnitudes is not large. They seem to be : numbers, wholes and parts, instants, the points on a straight line, the colours of the spectrum, and the pitches of sounds. There are doubtless others, which have not occurred to me ; but in any case, to be an independent series is to have a distinguished place among entities. This fact explains why such series have great philosophical importance, and why the theory of order is one of the most essential parts of Logic.

IV.—SOME NEW OBSERVATIONS IN SUPPORT OF THOMAS YOUNG'S THEORY OF LIGHT- AND COLOUR-VISION (I).

BY W. McDougall.

THE world of physiologists and psychologists is still for the most part divided into two parties on the question of the nature of the physiological processes that underlie our visual sensations; there are those who adhere to the Young-Helmholtz theory, and those who prefer some form of the theory put forward by Prof. Hering. But all are agreed that neither of these theories, as set out originally by Helmholtz and Hering respectively, is adequate to the explanation of all the facts, and several new theories have been propounded, notably those of Prof. Windt and Mrs. Franklin, while various attempts have been made to modify the two older theories so as to bring them into greater harmony with the facts; notable among the latter are the developments given to the Young-Helmholtz theory by V. Kries in his assumption of a separate white-exciting apparatus, and to the Hering theory by Profs. Ebbinghaus and G. E. Müller. Of late years many careful workers have made exhaustive examinations of the vision of colour-blind subjects, and of the peripheral parts of the retina of normal eyes, yet in spite of the skill and patience devoted to these researches, it will be generally admitted, I think, that they have failed to incline the balance decidedly in favour of either type of theory. It has seemed to me that a re-examination of the fundamental and comparatively simple phenomena of vision is much needed at the present time. Such a re-examination I have attempted, and I believe that the results afford conclusive evidence in favour of a modified Young-Helmholtz theory of light- and colour-vision. I should state that I, in common perhaps with most of those who have only a superficial knowledge of the subject, had come to accept the Hering theory as much more satisfactory and probable than the other, and that I was led into this

inquiry by noticing, during the course of observations made for another purpose, facts that seemed quite incompatible with the Hering theory.

I shall first describe in some detail observations on what I shall call "the complete fading of visual images," and on "the mutual inhibitions of visual images". I have failed to find any mention of these phenomena in the literature of the subject, and yet a right understanding of them seems to me essential to the establishment of a true theory of vision.

With the aid of this new knowledge I shall then examine exhaustively the question of a separate black-exciting process comparable to the processes that excite the sensations of colour, and shall show that the assumption of such a process is unnecessary and groundless.

In the second part of this paper I shall apply the same new knowledge to the elucidation of the phenomena of colour-vision, and shall show how it removes the main difficulties of the Young-Helmholtz theory in this field, and I shall support my conclusions with several series of observations on the images and after-images given by rays of light of fair as well as of low intensity.

SECTION I.—ON THE COMPLETE FADING OF VISUAL IMAGES.

So far as I have been able to discover, all writers on the physiology of the visual processes make implicitly or explicitly the assumption that the physiological and psychical processes in the visual areas of the cortex run so exactly parallel to the processes of the corresponding retinal areas that it is legitimate to infer the nature of the retinal processes directly from the nature of our visual sensations; if, for example, we have a distinct sensation of a bright after-image and the after-image disappears from consciousness or changes in colour, it is usually assumed that the retinal processes concerned in the production of the after-image have ceased in the one case or undergone a radical change in the other. This assumption lies at the root of many of the difficulties that arise in trying to explain the visual processes consistently, especially for the Young-Helmholtz theory.

Many facts of common knowledge indicate that this assumption is not valid, and yet they have not been brought together, and the necessary inference has not been made.

Thus in cases of struggle of the two visual fields, parts of

one field frequently disappear from consciousness entirely. Are we then to assume that (1) the retinal processes that were the basis of the sensation of those parts of the field have ceased, although the same rays of light continue to act upon the retina in all its parts; or (2), that the whole series of retinal processes and nervous processes of the corresponding areas of the cerebrum, runs the same course in the two cases, but is in the one case accompanied by consciousness, and in the other case is not? Or (3), is it not rather probable that, while the retinal processes continue unchanged during the period of invisibility of any part of one field, the nervous impulses set up by them in the area of the retina corresponding to this part of the field are prevented in some way by the influence of the competing field from reaching and passing through those parts of the visual cortex in which consciousness is immediately determined?

In the course of this paper I shall show that the first of these alternatives is not the true one. If we accept the second alternative we are driven to suppose that the disappearance of an image from the one field is due to purely psychical inhibition of it by the image excited in the other, *i.e.*, that one psychical process acts directly upon the other to abolish it without affecting the nervous processes by which it is determined. This seems *a priori* improbable, and the phenomena that I have to describe can be so much better accounted for in terms of the third hypothesis that I shall adopt it for convenience of description in this paper, merely noting that should the second one be eventually shown to be the true one, the validity of my conclusions regarding the retinal processes will not be affected. And I shall not attempt in this paper to define precisely the level at which the nervous impulses must be assumed to cease to propagate themselves when in the sort of case in hand a retinal process ceases to affect consciousness.

It is easy to show that the disappearance from consciousness of a visual image during the struggle of the two fields is but a special case of a frequently occurring phenomenon that seems to be due to a disconnexion between the retina and the higher cerebral centres, or failure of the nervous impulses set up by the retinal processes to propagate themselves to those cortical areas whose excitement is accompanied by consciousness.

In the first place, the way in which after-images frequently disappear and then after a few seconds as suddenly reappear, often in form and colour and intensity quite indistinguishable from their previous states, strongly suggests

that the retinal processes have continued unchanged, or only slowly changing during the periods of invisibility.

The suggestion is especially strong in the following case :—

Observation I.—I cut two round holes 2 cm. in diameter, and 5 cm. apart, in a large sheet of white paper and fixed the paper over the opening of a dark box (Dunkel-Tonne), so that the holes appeared as two black discs on the white paper. Then in diffused daylight I fixated a point on the paper midway between the two holes for two minutes. On excluding the light¹ I then saw two equally bright white after-images of the dark discs on a dark ground. After a few seconds they began to disappear and reappear suddenly and irregularly and independently of one another, although, on the whole, tending to alternate with one another, and so continued until they faded away. Yet the conditions that produced the two after-images were exactly the same, and it seems difficult to suppose that the disappearances were due to cessation or reversal of the action of the chemical substances in the retina.



FIG. 1.

A still stronger suggestion in the same direction is afforded by the following observation :—

Observation II.—If after fixating any patch of bright light on a dark background for thirty to sixty seconds, I completely exclude the light and watch the after-image it will disappear entirely if all light be kept from the eyes, perhaps after two or three short periods of invisibility. If then a very little light be admitted to the retinae for a few seconds (to expose the closed eyes to diffused daylight is often sufficient), the after-image will invariably recur for a short time and fade again after a few seconds when all light is again excluded. If the original after-image be a bright one, it may be revived many times in this way, and at each reappearance it is rather fainter than before, until it can no longer be revived by any

¹ In observing after-images I usually closed my eyes, as in the kind of observation with which I am chiefly concerned this does not introduce any disturbance, and I always, except where the contrary is stated, shut off also all light from the eyelids, either by closing the shutters of the dark room or with a dark cloth.

means. If, in such a case, exciting substances are set free in the retina by the light rays, and if they continue to act slowly upon the nerve endings by a further chemical change, during the whole period in which the after-image is capable of being revived, then it may be expected that these exciting substances will be used up, and the after-image become incapable of revival in the same period of time, whether it be visible during the whole of the period, or only during a part of it. The following series of observations shows that the duration in this sense is, as a matter of fact, the same in the two cases.

I fixated a square patch of bright white light on a dark background for fifteen seconds, and then excluding all light I observed the after-image, and as soon as it seemed to be on the point of disappearing I revived it every time by admitting a little light to the eyes. In this way I kept it continuously visible for five and a half minutes, and during this period it became gradually fainter until it faded altogether and could not be revived. I then, after a rest, fixated the same patch in exactly the same way, and for the same length of time, and then excluded all light from my eyes. The after-image faded completely after thirty-five seconds and remained invisible until after five minutes I admitted a little light, when it reappeared faintly, and it could be revived in this way up to five and a half minutes only.

Of a series of pairs of observations made in this way, all gave the same result, namely, that the period during which the after-image is capable of being revived is the same whether it is present to consciousness for the whole, or only for a small part of the period.

It seems then probable that in the case of after-images the retinal processes to which the image is due may continue to decline in intensity steadily, while the image comes and goes in consciousness or fades and remains absent from consciousness altogether.

If this be true, the question at once suggests itself—Why is it that visual images due to the direct action of light rays have not been observed to intermit in a similar manner? Now it is a well-founded hypothesis, which I have advocated in a former paper in this journal,¹ that perpetual change in the afferent nervous impulses reaching the cerebrum is an essential condition of continued consciousness, and in recent years we have come to recognise, thanks to the

¹ Vol. vii, "A Contribution towards an Improvement in Psychological Method".

experimental labours of Prof. Münsterberg and others, the importance of the part played by afferent impulses from the muscles in sustaining and re-enforcing sensations. But in the case of after-images both these supporting factors—namely, change in the afferent impulses from the sense organ and afferent impulses from the muscles connected with it—are present in very slight degree only. It might then be expected that on very accurate fixation of a steady source of light and relaxation of all the muscles of the eyes, both intrinsic and extrinsic, the image of the source of light might intermit, just as an after-image does. I find that this is the case, and the establishment of this fact is so important that I have made a large number of observations in which I have carefully fixated patches of steady light, relaxing at the same time as far as possible all the muscles of the eyes. Some practice was of course necessary before I could do this with ease, and in my earlier observations I used a dim illumination only. Some typical instances I will describe in detail, copying from my notebooks.

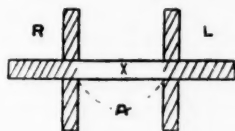


FIG. 2.

Observation III.—I took two strips of white paper about 2 cm. in breadth and 12 cm. in length and laid them upon the dark self-coloured carpet in the form of a vertical cross in the full light of a powerful lamp above my head. Then gazing at the cross I brought the visual axes of the two eyes to parallelism, allowing my accommodation to relax at the same time. Two images of the cross appeared, of course, gliding apart from one another until the visual axes became parallel, when they formed an image like Figure 2. Of this image the part A is formed by the parts of the horizontal strip that fall on corresponding points of the two retinae, and it appears as bright white, while the parts R and L are formed on the right and left retinae respectively, and appear as a duller white. Maintaining the visual axes parallel I looked up and down and all over the figure which during these movements remained absolutely steady and bright. I then fixated carefully at X, avoiding all movement or tension of the muscles of the eyes as far as possible. R and L

began to fade at once evenly and smoothly, and after three seconds they had entirely disappeared, leaving the strip A unchanged in brightness and form. After about three seconds both R and L reappeared suddenly, and the whole figure remained bright as when first fixated for some few seconds, then L disappeared, and then R, leaving A dim but visible in its whole length; then both returned as before; then the whole figure disappeared suddenly and after about three seconds as suddenly returned; then there were comings and goings of parts. This observation I repeated many times, and made the following notes on the series:—

The disappearance of A takes place much less readily than of R and L, and requires great steadiness.

The slightest movement of the eyes always restores the whole figure, and the reappearance of a part or of the whole usually coincides in time with a slight sense of muscular activity in or about the eyes.

In many cases, while the whole double figure was held fast without any sense of effort, the light of its parts flickered and wavered, dying out in large patches and coming again; often a wave of darkness seemed to sweep over the figure from one side or the other, and then before completely obscuring it to retreat, and so come and go several times. Sometimes there was a rhythmical coming and going of the whole figure until some one part refused to go, and the irregular partial fadings would set in. While the parts of the figure were going and coming I could momentarily turn my attention without difficulty to the dimmer objects of the periphery of the field, but sometimes when the whole figure disappeared all the peripheral field became dark also, so that while my eyes remained open and staring at this dim field with the bright white cross in its centre, the whole field disappeared from consciousness, and I experienced a sense of absolute and appalling darkness, very different from the result of merely shutting off all objective light.

In the above observation the fading of R and L may be rightly said to be due in part to the struggle of the two visual fields, *i.e.*, the dark ground of the field of the left eye struggles with the part of the field of the right eye occupied by the vertical strip and the left arm of the cross; but to say this is not to explain the phenomenon, and, as I have said, the disappearance of part of the field of one eye during the struggle of the two fields is but a special case of the more general phenomenon of complete fading of visual images. In the case of the strip A we have complete fading of a

bright image caused by light falling on corresponding areas of the two retinae; and here "struggle" plays no part.

I will now describe shortly two more typical instances of complete fading chosen from among many observations made under different conditions of colour and illumination.

Observation IV.—The cross used in Observation iii. was placed on a background of dark cloth at a distance of 1 metre from the face and in full lamplight, and was fixated in the same way as before, but with a red glass before the right eye and a blue glass before the left. An image of the form of Figure 2 was again seen, but R appeared red and L blue, while A appeared a bright whitish purple. Then on steady fixation, with the visual axes parallel and accommodation relaxed as before, the three parts of the figure

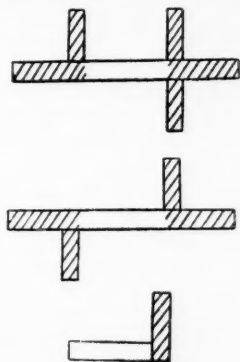


FIG. 3.

faded and returned apparently quite independently of one another. Sometimes the whole figure disappeared, sometimes A only remained. The limbs of the figure tended to fade and return separately, so that there appeared such images as those of Figure 3. A very striking and interesting feature was that the colours frequently disappeared from parts or from the whole figure, leaving the whole figure colourless and of an evenly bright silvery grey and considerably less bright than the original image. On the other hand, the colour sometimes persisted on a fading limb right up to the point at which the limb ceased to be visible. *This separate fading of the colour, leaving a grey image, affords a new proof, if any be needed, of the occurrence of a white-exciting retinal process independent of the colour processes.*

Observation V.—I laid a rectangular slip of white paper 10 cm. in length by 6 cm. in breadth upon a dark ground and fixated a spot at its centre in full lamplight, the visual axes being parallel and accommodation relaxed as before, and with a red glass before the right eye and a blue one before the left eye as in observation iv.

An image like Figure 4 then appeared, the part R being red, L blue and A a whitish purple. Then the following changes occurred:—

1. L faded leaving R and A unchanged.
2. L faded and A became indistinguishable from R, *i.e.*, the whole image of the left eye ceased to affect consciousness.
3. R faded, leaving A and L unchanged or leaving A and L of uniform blue.
4. The whole figure faded, sometimes the red and blue elements successively, sometimes R and L first, leaving A unchanged to fade later.
5. The whole figure became dim and colourless, or the colour of each part faded separately.

In every case the invisibility of any part lasted only from about one to five seconds.

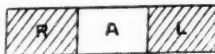


FIG. 4.

I have made a considerable number of experiments on the effect of activity of the ocular muscles in retarding the complete fading of visual images, and I find that while the greatest possible relaxation of all the muscles affords the conditions most favourable to fading, yet it may occur during all kinds of activity of the muscles so long as the image is not thrown on fresh areas of the retinae, but the greater the muscular activity the longer the fixation necessary before fading will occur, and the activity of the ciliary muscle seems to exert the greatest reinforcing influence. I have also made observations that show a similar reinforcing influence of activity of the ocular muscles upon after-images.¹

In my account of the fading of after-images I have brought forward some evidence to show that the chemical changes in the retina that I assume to be the exciting cause of the

¹ I hope to publish an account of these observations in a separate paper in which I shall deal with their bearing upon the theory of attention, and discuss the nature of the changes that accompany or determine complete fading.

after-image continue throughout the whole period during which an after-image is capable of revival in consciousness. In the case of direct images it seems *a priori* almost certain that the chemical changes in the retina by which the light-rays excite the nerve-endings must go on during the periods in which the images or parts of images fade from consciousness in such cases as those described above. But in order to prove this I made the following observations:—

Observation VI.—I took two squares of red paper each 2 cm. in width and fixed them on medium grey paper, their centres at my interocular distance apart, and on either side of the left square I fixed a tiny square of white paper, these also at my interocular distance apart. Then, wearing a + 4 D glass before either eye to define the images and assist in obviating accommodatory efforts I allowed my visual axes to become parallel and my accommodation to relax. The patches of paper then appeared as in Figure 5, RL being the image formed by the left-hand patch on the retina of the left eye and by the right-hand patch on the corresponding area of the right eye. Then on fixating the

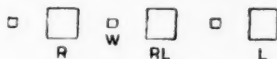


FIG. 5.

small white patch W, R and L faded very readily, but RL only after longer fixation. But the fading could be prevented for any length of time by very slight movements of the eyes. When I prevented them from fading in this way for thirty seconds and then turned my eyes to some other part of the grey paper, bright blue-green after-images of all three images appeared and lasted a certain number of seconds. But when I fixated W steadily from the first R and L disappeared after about three seconds and remained absent, until after thirty seconds I turned my eyes to another part of the grey paper. There then appeared after-images of R and L exactly similar in colour and saturation and brightness to those which followed the previous fixation and similar also to the after-image of RL which had remained visible during the whole of the period of thirty seconds, and the duration of the after-images was the same in the two cases. Now it is well known that within wide limits the saturation and the duration of after-images observed in this way, *i.e.*, by projection on a grey surface, varies with the length of time that the source of light has acted upon the retina, and it is therefore

necessary to believe that the rays of light from the red patches were producing just the same chemical changes in the retina in both cases, *i.e.*, both when the images were visible for the whole period of thirty seconds, and when they were visible for three seconds only and invisible for the remaining twenty-seven seconds.

Observation VII.—An easier and more striking way to show this is to place a strip of red paper about 12 cm. in length and 3 cm. in breadth upon a sheet of green paper. With the visual axes parallel, an image like figure 6 is seen, of which RL is due to stimulation of corresponding areas of the two retinæ by the red strip while R and L are due to stimulation of areas of the right and left retinæ respectively. If then the figure be steadily fixated at X the piece R will disappear very quickly, after perhaps one or two seconds and will remain invisible for many seconds while RL remains bright red. On then turning the eyes to another part of the green ground an after-image of the whole strip appears as a band of very bright green on the duller green of the ground,



FIG. 6.

and the after-image of the part R is equally bright with that of the part RL.

My most successful observation of this kind was made when I had acquired great facility in the relaxation of the ocular muscles and in steady fixation.

Observation VIII.—I closed the right eye and fixated with the left eye with relaxed accommodation a white spot on a grey ground mid-way between two patches of red paper. The steady fixation and relaxation of the ocular muscles were maintained without any sense of effort for several minutes. The red patches faded completely almost at once, and after a few more seconds the whole field became a misty black and remained so for more than two minutes with occasional very dim appearances of the white spot and sometimes also of the red patches lasting every time less than one second. A very slight lateral movement of the eye then restored the whole field to consciousness, and on turning the eye to another part of the grey paper there appeared vivid blue-green after-images of the two red patches that lasted many seconds.

These observations seem to me to establish beyond question that

a ray of light that usually excites a vivid image may continue to produce in the retina the normal chemical changes without continuing to affect consciousness, if the re-enforcing factors of novelty of stimulus and muscular reaction be precluded. ✓

One other observation is of importance here. It is now generally agreed that the direct image and the after-image have their primary seat in the same part of the cerebro-retinal system, and the following observation affords additional evidence of this.

Observation IX.—If a red patch on a grey ground is fixated for thirty seconds or more and then the green after-image is projected on the grey ground beside the red patch, and the ocular muscles completely relaxed, the red and the green images will usually fade and reappear together, showing that they are affected in the same way by the same factors.

SECTION II.—THE MUTUAL INHIBITIONS OF VISUAL IMAGES.

As I have pointed out above, the disappearance of part of one visual field, during the struggle of the two fields, seems to be merely a special case of the more general phenomenon of the complete fading of visual images. This statement finds further support in the following facts: Firstly, the mode of disappearance and reappearance is exactly similar, the fading is smooth and rapid, the return is startlingly sudden; secondly, the fading, whether under the influence of "struggle" or not, is affected in the same way by the same factors. In both cases it is favoured by passivity of the ocular muscles and prevented or much retarded by changes in the visual field and by muscular activity. In this connexion I refer to the paper on inhibition by Mr. Breese,¹ in which he shows that movements of the eyes tend to prevent the fading of parts of the fields during "struggle," and that if the image presented to one eye be made to undergo continual changes (in this case by movements of lines drawn across the field) the complete fading of that image is prevented. I have mentioned above my own observations on the influence of muscular activity in retarding the fading of images not due to struggle. I need only state here that they are in entire agreement with those of Breese.

In the ordinary cases of struggle of the two fields, the fading of part or the whole of one field must be regarded as

¹ Monograph Supplement to the *Psych. Review*, May, 1899.

due to inhibition by the other field, *i.e.*, an image excited in one retina is driven from consciousness, *i.e.*, inhibited, by an image different in form or colour on the corresponding area of the other retina.

The question then presents itself, If different images on corresponding areas of the two retinae thus inhibit one another, cannot an image formed in one part of the retina inhibit an image in another part of the same retina? The most direct and satisfactory proof of this is afforded by the following observation:—

Observation X.—I fixed a photographic shutter over an opening in the window-shutter of the dark room and over the former a sheet of milk glass, so that when the photographic shutter was opened there appeared on the milk

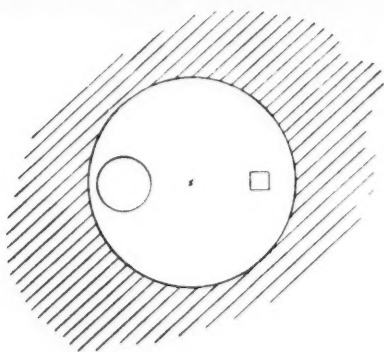


FIG. 7

glass a bright white disc about 5 cm. in diameter. At a distance of 15 cm. from this disc I fixed a square of white paper 2 cm. in width and under an illumination such that I could just read small print held up at the same place. At a distance of 1 metre I fixated a spot midway between the square and the disc, through an artificial pupil about 1.5 mm. in diameter held before the right eye. The field of view was then like the Figure 7, the dull white square at one side of the circle formed by the artificial pupil, and the disc (not yet lit up) at the other side of the circle, and the point of fixation in the centre. After thirty seconds' fixation I opened the photographic shutter, so causing the appearance of the bright white disc; the white square at once disappeared, leaving a dark square in the midst of a less dark haze that filled the circle of the artificial pupil.

On continuing the fixation the square does not regain its previous whiteness, but as the disc darkens from fatigue a dull grey begins to flicker over the square, and with slight waverings of fixation its edges start out in bright white. I repeated this many times, fixating for various periods before lighting up the disc; if this period was only about five seconds the square does not disappear but merely darkens when the disc is lit up, and the longer this period the more the square darkens, until when the period is as much as twenty-five seconds or more the square always fades completely.

This is only one of many similar observations of the complete inhibition of one direct image by another on the same retina. If the artificial pupil is not used the fading of the duller and first fixated image takes place even more readily because the exposure of the brighter disc causes the pupil to contract and so cut off from the retina a part of the rays from the duller square.

A direct image on one retina may also be inhibited by a direct image on the other retina, when the two images do not fall on corresponding parts as they do in the case of struggle of the two fields.

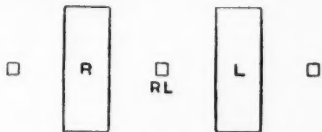


FIG. 8.

Observation XI.—I put a slip of white paper about 5 cm. in length and 2 cm. in breadth upon a flat surface of black velvet, and on either side of it a very small piece of white paper, the two being at my interocular distance apart. Then in strong lamplight and with visual axes parallel, I fixated the right-hand spot of white with my right eye. An image like Figure 8 then occupied the field. On continuing the fixation with relaxed eye-muscles R and L faded completely and returned many times, sometimes together, sometimes separately. If then I brought up a sheet of dark cardboard before the left eye so as to completely fill its field and shut out the image L, R faded less readily than before, but if at any time when R was present to consciousness I withdrew the cardboard a little to the left so as just to expose the image L to the left eye, but no farther, then R always faded completely and at once. If the period during

which L was shut out and R only present had been short, then after exposure of L, R would remain absent from consciousness for a few seconds only, but if the period were longer then R would remain absent for a longer time. In making this observation it is important not to withdraw the screen from the left eye so far as to expose to the black velvet the part of the retina corresponding to that part of the right retina on which the image R is formed, for then the result is not a pure inhibition effect, is not due solely to inhibition of R by L.

An instructive case of the mutual inhibition of images on non-corresponding areas of the two retinae is afforded by the binocular combination through fixation with parallel visual axes of a vertical and a horizontal white strip on a dark ground. We then have an image like Figure 9 A. Or still more simply we may fixate, with visual axes parallel, a horizontal strip of white paper about 12 cm. in length on a

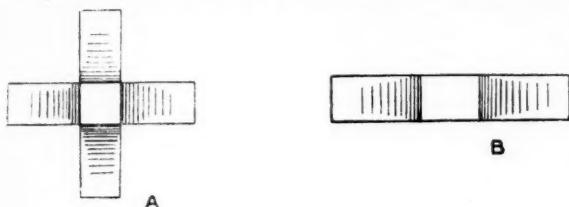


FIG. 9.

dark ground. The lateral parts of the figure then tend to fade irregularly and frequently, but during a large part of the time an image like Figure 9 B appears. The middle piece of bright white is the image formed on corresponding areas of the two retinae. On either side of this is a grey strip, darkest where it adjoins the middle piece and dull white towards the other end. These are the images formed on non-corresponding areas. They frequently fade completely under the inhibiting influence of the bright middle piece, and this influence appears to be strongest in its immediate neighbourhood, and to diminish regularly with the increasing distance from it.

There remains a fourth conceivable form of mutual inhibition of or "struggle" between direct images, namely, the struggle in consciousness between different images thrown at the same time upon the same area of one retina. The proof of the occurrence of this form of mutual inhibi-

tion I shall defer until I come to treat of colour vision, and I will now turn to the exposition of a factor that determines to a very great extent the predominance of one image over another, whether the two images be formed on corresponding areas of the two retinæ, or on non-corresponding areas of the two retinæ, or on separate areas of one retina. This factor is the newness of the image in consciousness. Of two images, equally bright and large objectively, the one that has been present to consciousness the longer succumbs to one newly appearing to consciousness, and the longer it has been present to consciousness the more readily it succumbs to the inhibiting influence of the other. This appears clearly in both Observations x. and xi. It is owing to this that we get a perpetual alternation of the two fields in most ordinary cases of struggle. It can be well studied by combining binocularly the cross-lined squares of figure x. in plate viii. of Helmholtz's *Physiologische Optik*.

Observation XII.—After a little practice I was able to bring the image of one over that of the other by fixating with visual axes parallel and at the same time maintain full accommodation. Then the two sets of lines alternated in consciousness in patches, but if I fixed my attention upon a short length of two neighbouring parallel lines and steadily fixated them, I found that I could hold them in consciousness while all the neighbouring lines of that set disappeared and those of the other set appeared, so that I saw a single diamond among the parallels. I could continue to hold these two short lengths while the other lines of this set alternated several times with those of the other set, but all the time the effort of attention seemed to grow until I could sustain it no longer and the lines disappeared and remained absent for a considerable period;¹ thus the longer these lines had been present to consciousness, the greater was the effort of attention necessary to retain them and after this prolonged stay a longer period than usual elapsed before they predominated again over the lines of the other set.

If I am right in believing that complete fading is due to a failure of the nervous impulses to propagate themselves through the highest cortical levels, it would seem that this yielding of the image that has been long in consciousness to one newly appearing is due to a fatigue of these highest cortical levels that sets in very rapidly and expresses itself

¹ A similar result of an effort of attention is described by Herr Witasek (*Zeitsch. f. Psy.*, Bd. 19). Breese quotes this as unique and reports that neither he nor his pupils could obtain this result.

as an increased resistance of the nervous paths to the passage of the impulse. This view is further supported by the following fact: If, during Observation iii., the whole figure be kept in consciousness for some time, say thirty seconds, by very slight movements of the eyes, the whole of it tends to fade completely and remain absent from consciousness for a longer period than usual when the movements cease, and the longer the fading has been prevented, the longer is the period it remains absent.

If after-images are due to chemical changes in the retina in just the same sense as are direct images, then they should be subject to similar inhibitions, either by direct images or by other after-images, and this is the case. Perhaps the most elegant method of observing the mutual inhibition of two after-images on one retina is the following:—

Observation XIII.—In the circular opening of a dark box,

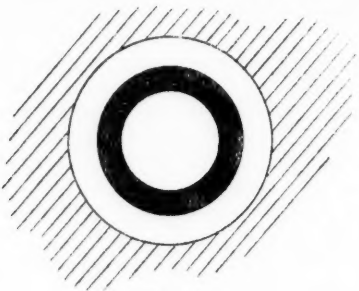


FIG. 10.

I put a ring of white paper, 1 cm. in breadth and about 5 cm. in diameter. Then in bright daylight I fixated the centre of the circle at a distance of 1 yard and for two minutes. During fixation the black inner circle and the broad black ring outside the white ring become suffused with a grey light (simultaneous induction). On excluding all light there appeared at once the negative after-image of the Figure, a bright white disc surrounded by a black ring and separated by it from an equally bright outer ring as in Figure 10. (The grey of the black velvet front of the dark box is bright enough to define clearly the outer white ring of the after-image.) During the first forty seconds both were bright and steady. Then the disc faded completely and suddenly, leaving the ring alone on a dark ground. Then after about five seconds the disc reappeared

and at the same moment the ring faded completely, leaving the disc alone for five seconds. They continued to alternate in consciousness in this way until each had faded nine times. Sometimes as one reappeared the other would persist for as much as two seconds before fading, and twice both were absent together for about two seconds.

I repeated this many times with different periods of fixation and in every case with a similar result, an alternate complete fading of the bright disc and the bright ring in the after-image, beginning after a short period in which both persisted equally bright and continuing until both became dim.

I then varied the conditions by putting a white ground around the circular aperture of the dark box. There was then a more rapid induction of white light over the dark ring than over the central disc and the after-image of the ring appeared brighter than that of the disc. The ring then persisted almost continuously, while the disc kept coming and going.

I then turned the balance in favour of the disc by removing the white paper ground from the dark front of the dark box and putting a small disc of white paper at the centre of the aperture. The after-image then appears as a bright inner ring and a less bright outer ring and the former predominates over the latter, *i.e.*, the inner ring persists while the outer ring comes and goes.

This phenomenon, the mutual inhibition of after-images, may be most easily observed by fixating a bright sky through the window panes. In the later stages of the after-image obtained in this way, the halo (or *Lichthof*) may usually be seen to alternate in consciousness with the positive after-image of the bright panes.

The inhibition of an after-image by a direct image on another part of the same retina, and on a non-corresponding area of the other retina may be easily observed as in the following cases:—

Observation XIV.—I fixated with the right eye the shaded disc,¹ brightly lit by diffused daylight from the outside with white light, for sixty seconds. On closing the shutter there appeared a bright positive after-image. This I projected on to the dark wall beside the shaded disc at an angle of about 15° from it and then opened the shutter again so as to illuminate the shaded disc again. The after-image at once disappeared entirely for ten seconds and then returned, very

¹ This shaded disc is described in the account of Observation xvi.

dim at first and increasing in brightness. This I repeated many times with a similar result on each occasion. In these observations the left eye was completely covered. I then repeated the observation with this difference only, that when the after-image had appeared, after fixation of the disc by the right eye, I exposed the left eye to the light of the disc, shielding the right eye from its light but projecting the after-image beside the shaded disc and at about an angle of 15° from it as before. The after-image then disappeared at once and returned again as before, the only difference being that in the latter case it remained invisible for a shorter period (about five seconds only) than in the former.

An interesting variation of this observation is the following: Instead of the shaded disc, I fixated, with the right eye only, the brightly lit and sharply bounded disc¹ for thirty seconds. The after-image, a disc of very bright colour, I projected beside the disc and then lighted up the disc again by opening the shutter. The bright colour disappeared at once and a fairly bright white halo appeared around the dark disc that replaced the colour, *i.e.*, the positive after-image was reversed and became a negative after-image. On continuing the exposure to the bright disc, the bright colour of the after-image returned after about ten seconds and then a few seconds later the halo faded completely. This too I repeated many times with similar results. In this case the halo is at first inhibited by the bright after-image, and then when the after-image itself is inhibited by the bright direct image the halo returns to consciousness—the corresponding cortical area being fresh as compared with that of the after-image itself, and then, when the fatigue of the cortical area of the after-image passes off during the period of fading and the after-image returns to consciousness the halo is again inhibited by it. This phenomenon of the reversal of the after-image, from positive to negative or from one colour to another, may be easily observed in a rough manner by opening and shutting the eyes before a sheet of W paper after fixating a bright sky through the window panes.

The consideration of mutual inhibitions of after-images on the same area of the same retina I defer together with the similar case of direct images until I treat of colour vision.

In the previous section I have shown reason to believe that the complete fading of visual images is due, not to a change in the retinal processes, but to a failure of the nervous impulses, excited in the retina by the chemical

¹ See Observation xviii.

changes going on there, to propagate themselves through those highest levels of the retino-cerebral system in which consciousness is immediately determined. In the case of the inhibition of an image formed on one retina by an image on the other retina, it is clear that the antagonistic interaction of the two processes is not in the retinae but in the brain. To inquire into the mode of this interaction and its exact seat is not necessary for the purpose in hand. I will only remark in passing that the right understanding of this interaction seems to me essential to the understanding of the attention process in general. It seems, however, highly probable that this interaction takes place in the highest levels, and I shall for convenience speak of it as taking place in the cortex of the cerebrum. It is clear that if the antagonistic interaction of images on the two retinae is cortical then the similar interaction of two images on different parts of one retina is also cortical, for the latter resembles the former in every way and it takes place between images at considerable distances apart on the retina, without producing any appreciable change in the state of the part of the retina between the images.

One other fact of importance appears clearly in all my observations on complete fading and mutual inhibitions—it is that every definitely bounded and homogeneous part of a complex image tends to fade and reappear as a separate whole, more or less independently of the other parts, as in the following case:—



FIG. 11.

Observation XV.—I fixated the middle arch of my Gothic window against an evenly bright white sky for sixty seconds. This section of the window is divided by one vertical and three horizontal narrow leaden strips into eight square

panes. The panes appeared in the after-image all of the same colour and equally bright, nevertheless after some seconds, the four panes of one vertical row faded completely and returned several times while those of the other vertical row remained almost unchanged and then the separate panes began to fade and return quite independently and irregularly.

SECTION III.—AN EXAMINATION OF THE GROUNDS OF ASSUMPTION OF A BLACK-EXCITING PROCESS.

The occurrence of negative or S^1 after-images of W objects has been a great difficulty to the supporters of the Young-Helmholtz theory, and Helmholtz's psychological explanations of the facts of simultaneous and successive contrast and induction (I use these terms in the same sense as they are used by Hering) must be admitted to be unsatisfactory by every impartial observer. It was for the explanation of these facts that Hering introduced the hypothesis of an S-process, *i.e.*, a special physiological process comparable to those concerned in production of the sensation of W or the colour-sensations. And with this hypothesis of an S-process Hering's whole scheme of explanation of light and colour-vision must stand or fall.

If we examine the evidence for the S-process, it appears to consist in the facts of simultaneous and successive contrast and induction of W and S and in the two assertions: (1) that the processes that determine the sensation of S bear to those that determine the sensation of W a relation similar in every way to the relation of the processes that determine the sensations of G to those that determine the sensation of R, or of those that determine the sensation of B to those that determine the sensation of Y, except that there is no objective stimulus for the S-process; (2) that the mixing of S with any colour has the effect of diminishing its saturation in just the same way as the mixing of W with it.

The existence of the greys forming a perfect series from S to W is admitted by Hering to constitute an important difference between the relation of S to W, and that of G to R or B to Y, but he is content to leave it unexplained. Prof. G. E. Müller, on the other hand, attempts to overcome this difficulty by assuming that there is always at work an endogenous cerebral excitation that manifests itself, if pure, *i.e.*, unaffected by processes excited in the retina, as a

¹ I propose to use the letters R, Y, G, B, P, W and S for red, yellow, green, blue, purple, white and black respectively.

medium grey sensation filling the whole visual field, and that the W- and S-processes, adding W or S to this sensation in different proportions, yield in this way the quality-rows, grey to white and grey to black respectively. This assumption seems to me to push the difficulty but one step backwards. It may fairly be asked, Why then is there no similar cerebral excitation of a Y-B process and of an R-G process? and one might dwell upon the difficulty of imagining the phylogenetic origin of such an endogenous grey process bearing this extraordinary relation to the S- and W-processes. But happily this is not necessary. Müller has reduced Hering's somewhat loosely conceived scheme to logical form, and has radically modified it by introducing the conception of reversible chemical processes, affecting three retinal substances, the W-S, the R-G, and the Y-B substances, each of the two opposite changes in each exciting one of the pair of sensations. But in giving it greater definiteness and self-consistency he has rendered it easier to attack. I will therefore quote here his explicit statement as to the way an S after-image must follow stimulation of the retina by W light.

“Das Ueberwiegen der W-Reaktionen ueber die S-Reaktionen, das waehrend der Lichteinwirkung statt-findet, ist (trotz der Mitwirkung des Blutstromes) mit einer Abnahme des W-Materiales und Zunahme des S-Materiales, einer Verringerung der Grösse M_w und Erhöhung von M_s verbunden. Wird nun die Lichteinwirkung plötzlich beendet, so kehren die Konstanten K_w und K_s wieder zu ihren anfänglichen Werten (ihren Ruhewerten) zurück. Aber schon bevor sie dieseiben völlig wieder erreicht haben, müssen infolge der durch die vorherige Lichteinwirkung bewirkten Erhöhung von M_s und Verringerung von M_w die S-Reaktionen ueber die W-Reaktionen ueberwiegen. Kurze Zeit nach Beendigung der Lichteinwirkung besitzt also die Differenz $I_w - I_s$ einen negativen Werth, die Empfindung ist zu einer vorwiegend schwärzlichen geworden, *wir beobachten das negative Nachbild des vorher wahrgenommenen weissen Objektes. Je länger die Betrachtung des letzteren gedauert hat, und je heller dasselbe war, desto mehr muss bei aufhören der Betrachtung desselben das S-Material vermehrt und das W-Material verringert sein, desto ausgeprägter muss also das negative Nachbild ausfallen.* Und da mit dem Grade der eingetretenen Vermehrung des S-Materiales und Verringerung des W-Materiales zugleich die Zeit zunimmt, welche verfließen muss, damit sich das Gleichgewicht zwischen den W- und den S-Reaktionen wiederherstellt, *so wird mit der Dauer der*

*Betrachtung des weissen Objektes und mit der Helligkeit des letzteren zugleich auch die Dauer des negativen Nachbildes zu nehmen."*¹

In this explicit statement that the stronger the W light and the longer the period of fixation, the better marked and the more lasting must be the S after-image, we have a touchstone for Müller's theory. This is based not only upon an examination of the facts, but also upon strictly logical deductions from certain psycho-physical axioms, and if observations should show the deductions to be at variance with the facts, then the axioms, so-called, must be *regarded with suspicion* and the method and the conclusions to which it has led must be held to be invalid.

Positive after-images seem to have been quite unfairly neglected by recent observers, and in almost all text-books appear statements that lead the reader to suppose that positive after-images are rare phenomena and difficult of observation. Thus, if I take up at random Sandford's *Experimental Psychology*, I find on page 113: "The positive after-image is of short duration and less readily observed than the negative," and more to a similar effect.

From casual observations I had learnt that in my own case a prolonged positive after-image follows the fixation of W objects more frequently than a negative or S after-image. But the accurate ascertainment of the facts is of fundamental importance, and I have therefore made many systematic series of observations on the after-images produced by the fixation of patches of W light of various intensities and periods of duration and with borders variously defined. I have used various sources of W light, namely sunlight, diffused daylight, and lamplight reflected from white paper, patches of sky and white clouds, and gaslight and daylight, thrown upon milk glass. These all give essentially similar results, and I will describe only three series in each of which the source of light was a patch of daylight reflected from white clouds upon a sheet of white milk glass. The milk glass was suspended over an aperture in the window-shutter of the dark room, and in the aperture was a photographic shutter which, when closed, completely excluded the light, and when opened allowed the light of the sky to fall upon an area of the milk glass.

Observation XVI.—In series A the glass was covered with

¹ G. E. Müller, on "Psycho-Physik der Gesichtsempfindungen" in *Zeitschrift für Phys. u. Psy. der Sinnesorgane*, vol. x., p. 346. The italics are mine.

opaque black cloth, except a circular area in the centre, 12 cm. in diameter, on which the light fell. On the outer or farther side of the glass about a dozen sheets of thin white paper were pasted, each with a circular hole in it concentric with the hole in the cloth. Of these holes the smallest was 2 cm. in diameter, and of the others each was about 1 cm. larger in diameter than the preceding one. On opening the shutter there then appeared a central evenly bright W disc 2 cm. in diameter, and from its margin the brightness diminished regularly through a zone 5 cm. in breadth until at the black cloth there was no perceptible brightness. This disc I shall speak of as the *shaded disc* or A disc.

Observation XVII.—In series B I used a disc with a clear centre of milk glass 5 cm. in diameter, and with a shaded zone 2 cm. in breadth. This I shall speak of as the *half-shaded disc* or B disc.

Observation XVIII.—In series C the milk glass was covered with black cloth, except a central circle 5 cm. in diameter, and this, when the shutter was opened, gave a disc of W light sharply bounded by black cloth. This I shall speak of as the *unshaded* or C disc.

By reflecting sunlight from a flat mirror on to the milk glass I could make the clear areas of the discs a very bright W, and by exposing them to skies of varying brightness, and by putting sheets of white paper outside the milk glass, I could obtain W and greys of all degrees of brightness, down to the dullest grey that would yield any after-image.

With each of these three discs I made many series of observations with different degrees of illumination from very bright W to dull grey. For each degree of brightness I made fixations of 1, 2, 5, 10, 20, 40, 80 and 120 seconds, in every case fixating the centre of the disc with both eyes at a distance of about 50 cm., and shutting off the light completely and suddenly at the end of the period by releasing the photographic shutter.

The results may be summed up by saying that in every case, *i.e.*, with every combination of brightness and duration of fixation, within the limits above mentioned, *the shaded and the half-shaded discs gave only positive after-images that faded slowly and regularly*, with sometimes one or two short periods of "complete fading," until they become too faint to be distinguished from the "intrinsic" light of the retina; *and they never gave a negative after-image, i.e.*, the area of the image never appeared darker than the general field, or than the immediately surrounding parts of the field, at any time during the minutes following the fixation. In the case of

the shaded disc the after-image always appeared shaded off into the general ground just like the disc itself. In the case of the half-shaded disc there was, with combinations of the longer fixations and brighter illuminations, usually some trace of a grey or W halo (Lichthof of Hering), but this was never brighter than the after-image on the directly affected area. In order to describe shortly the nature and course of these positive after-images, I will divide the different degrees of brightness of the centres of the discs into three groups, namely, the bright W, the W of fair brightness and the greys.

The after-images given by discs of the first class, the bright W, are always bright and more or less coloured during the greater part of their duration, and the brighter the disc the more saturated is the colour of the after-image, and the longer the fixation of the disc the longer is the duration of the after-image; but the shorter the fixation (down to one second) the brighter is the after-image in the first few seconds, and the more rapid is the decline of its brightness.

The after-images from discs of the second class, those of medium W, are coloured after all but the shortest exposures, but the colours are usually of low saturation.

The after-images from discs of the third class, the grey discs, are of dull hazy grey, and of short duration (there may be a faint tinge of colour in the first few seconds). The decline of brightness and the duration of the after-images of the discs of the second and third classes follow the same rules as those of the discs of the first class.

Of the after-images given by the disc C, the sharply-bounded evenly-bright disc, it may be said that there always appears some halo effect (some Lichthof), except for the shortest fixations, and the halo is brighter and broader the longer the duration of the fixation. When the brightness of the disc C is of the first class, the area directly affected always appears in the after-image brightly coloured (as with discs A and B), and the halo is usually coloured also, and in a colour different to and approximately complementary to that of the after-image itself. There is then a tendency for the after-image to fade completely for short periods, leaving the area S and surrounded by the bright halo, and also for the halo to fade completely at other moments, and leave the bright coloured after-image alone in consciousness.¹

¹I find it very convenient in describing after-images to denote by "after-image" the appearances on the area directly affected by the light rays, excluding the halo or other appearances in the indirectly affected area.

With degrees of brightness of the third class, namely greys, and also after the shorter fixations of brightnesses of the second class, the C disc gives dull grey after-images, sometimes tinged with colour, and usually surrounded by faint halos. The after-image and its halo then die away slowly together, one or other occasionally fading completely for a few seconds.

Lastly, with degrees of brightness of the second class, and with the longer fixations (30-120 seconds) of the C disc the after-image usually appears as an S area surrounded by a more or less bright W halo, and the longer the fixation the brighter is the halo, as in all cases in which the halo appears. The brighter the halo the more completely and continuously dark is the area surrounded by it. But in most cases there appears some light within the area during the course of the after-image, most frequently a dark green of fair saturation. In many cases the area is filled with dull light during the first few seconds, and then there appears a zone of S between it and the halo, and this zone increases slowly until towards the end of the life of the after-image, a small irregular patch of dark green alone remains about the centre of the area bounded by the halo.

In order to prove that I am not peculiarly prone to see positive after-images I have asked two other persons to make similar but less elaborate series of observations on the after-images given by patches of W light using my apparatus. The after-images seen were similar in every way to those described above.

To sum up the results of my observations on the after-images that I see after fixation of patches of W light—Under all conditions, except one narrowly-defined set of conditions, W light gives a positive, *i.e.*, a W after-image only (or if coloured, the after-image is always brighter than the ground) and a negative or S after-image only appears when the patch of W light is sharply bounded by a much darker background and is of medium brightness and is fixated for a fairly long time. These are the conditions that give a relatively bright halo, and such a halo is invariably present when the area directly affected by the W light appears S in the after-image.¹

¹ I leave out of account the appearances that follow stimulations of the retina of very brief duration, as they do not seem to be of primary importance for my purpose. I am familiar with the rapid darkening and brightening that the after-image frequently undergoes in the first second after the light is suddenly shut off from the eyes, and it seems to me highly probable that this darkening is due to cortical rather than to

It will be noticed that this set of conditions is that which obtains when a patch of white paper is fixated upon a black or dark grey background in the diffused light of any ordinary room. Hering in his original communication,¹ describes only after-images of W light obtained in this way, and most recent observers would seem to have studied chiefly such after-images.

We have seen that Müller is quite explicit, and in the passage I have quoted (p. 73) lays down the requirements of his theory, namely, that fixation of a W patch must give an S after-image in all cases, and the longer the fixation and the brighter the W the more marked must be the S after-image and the longer its duration. My series of observations, xvi., xvii. and xviii., show that this dictum is true only of a very limited class of cases, those, namely, in which the conditions are such as to produce a relatively bright halo, while in all other cases, it is directly opposed to the truth for the after-image produced by the action of W light is positive, i.e., W or grey or coloured, and brighter than the rest of the visual field.²

It is an essential part of Hering's theory (as also of Müller's) that the relation of S to W is similar to that of G to R, and of B to Y, and every important exception to this rule must be regarded as a grave objection to the theory and to all theories of this type. In order therefore to compare these relations I have made series of observations on the after-images given by coloured lights under conditions similar to those of series xvi., xvii. and xviii. I used the same discs A, B and C and coloured the discs by placing sheets of coloured gelatine outside the glass plate, so that the light must pass through them before reaching the plate.

retinal changes. I will only refer to the paper by Herr Munk (*Zeitsch. f. P. u. P. d. Sinnesorgane* Bd. 23) in which he shows that the after-image caused by all short periods of stimulation by W light up to two seconds is always positive, i.e., brighter than the ground in spite of the momentary darkening in the first second.

¹ Zur Lehre vom Lichtsinne.

² The psycho-physical axioms from which Müller deduces his theory of visual sensations are not axioms in the strict sense of the word, but are an elaboration or detailed setting forth of the doctrine of parallelism or simple concomitance of consciousness that is the foundation of all psycho-physics in Müller's sense of the word. I have set forth in the paper referred to above (*MIND*, vol. vii.) my reasons for rejecting this doctrine, and when we find that, as in the present instance, logical deductions from it lead to conclusions opposed to the facts we have one good reason the more for asserting that however useful it may have been and still may be as a working hypothesis, yet it is nothing more than that.

I have made in this way with R, G and B light (as well as other colours) series of observations parallel to those with W light.

Observation XIX.—These I may summarise for the present purpose as follows: With the brightest illumination of the discs they all give brightly coloured after-images.

With the lowest intensities (corresponding to the third group of the foregoing series) and also with the shorter durations of medium intensities, the after-image is a grey of a brightness in the first moments varying inversely as the duration of the fixation, as in the W light series.

With medium illumination (corresponding to the brightness of the second group in the foregoing series) all three discs give (except after the shortest fixations) after-images that, though often same-coloured in the first one to three seconds, are very differently coloured, and in the great majority of cases approximately complementarily coloured, through almost the whole of their course. In the case of R and G especially, it is very constantly the rule that R predominates in the after-image of G, and G in the after-image of R.

In the case of the C disc there is usually, as in the case of W light, a well-marked halo about the after-images in this group of cases, and it is usually approximately complementary in colour to the after-image itself.

The discs A and B give then with W light and medium brightness positive, *i.e.*, W after-images, while, under exactly similar conditions, but with coloured light, they give predominantly complementary coloured after-images. In the latter group of cases the complementary after-images appear as the immediate result of the stimulation with coloured light, whereas the appearance of an S after-image after stimulation by W light is dependent upon the presence of those conditions that determine the appearance of a relatively bright halo. Here, then, is a second fundamental difference between the relation of S to W and that of G to R or B to Y.

THE EXPLANATION OF THE FACTS OF SIMULTANEOUS AND SUCCESSIVE CONTRAST AND INDUCTION.

I believe that the observations recorded in sections i. and ii., and in the foregoing part of this section, enable us to arrive at the true explanation of the facts of simultaneous and successive contrast and induction as described by Her-

ing.¹ I will first set down shortly what I take to be the true account of the processes concerned in the production of the phenomena of W-vision (including under this term vision of S and all the greys).

When W light acts upon an area of the retina it sets free in it, probably by a process of decomposition of stored-up mother substances, substances that by a further chemical change, probably one of combination, excite or stimulate the rods or cones or both, so that nervous impulses are started in them and are transmitted, under favourable conditions, to the visual areas of the cerebral cortex. The former change takes place under the action of light rays only (or other external stimuli such as pressure), whereas the latter can go on in the absence of all light rays, but is accelerated by their action.

The light rays produce these changes in greater or less amount according to their intensity. The exciting substances, which I shall speak of as the X-substances, are of a highly diffusible nature, and if a sharply-bounded W patch be fixated the X-substances diffuse themselves into all the surrounding parts of the retina and there give rise, under favourable conditions, to impulses that excite the W sensation. *This is simultaneous induction of W.* The cortical processes excited by the W patch tend to inhibit all those of the rest of the visual field, and if the patch be upon or surrounding a dark grey field, the cortical processes of the parts of the visual field in its immediate neighbourhood are completely inhibited and the visual sensations of these parts undergo complete fading for a time, and the area immediately surrounding the W patch therefore appears S. *This is simultaneous contrast.* But with continued fixation the quantity of X-substances diffused into the immediately surrounding area increases until the cortical processes excited by their activity in the retina become too intense to be inhibited by those of the neighbouring W area, and the induced light appears suddenly in consciousness. *The contrast S gives place to induced W.*

When the light rays suddenly cease to reach and act upon the retina, there remains a certain quantity of the X-substances in the retinal area directly affected and also in the immediately surrounding areas into which they have diffused during the fixation. If the W of the patch be of fair intensity and the fixation of short duration, the amount of X-substances per unit area of the directly-affected part and

¹ Zur Lehre vom Lichtsinne.

of the immediately surrounding parts may be approximately equal. Both will then excite a sensation of grey, and this sensation may be present for both areas simultaneously, or owing to mutual inhibition of the two sets of cortical processes the sensations determined in the two areas, the after-image and its halo, may alternate in consciousness. If the W patch be of medium brightness and sharply defined, and the fixation be long continued (sixty seconds or more), the amount of X-substances diffused out is greater, so that the amount of X-substances accumulated in the unit area of the surrounding parts may be greater than in unit area of the directly-affected part, and the fatigue¹ of the directly-affected area is considerable. Hence the cortical processes excited by the activity of the X-substances in the former area predominate over those excited by the X-substances in the latter and completely inhibit them, and the after-image therefore appears as a W halo surrounding an S area. *This is successive contrast and successive induction* (or the formation of a negative after-image). If the W patch be very bright or dull, or the exposure of short duration only, the X-substances diffused out are not so relatively abundant as to cause the predominance of the corresponding cortical areas, and a positive or W after-image appears with or without a halo.

If the W patch is not sharply bounded, but fades off into the dark ground, then there is no considerable accumulation of X-substances about the directly-affected area, and there remains on shutting out the light only a sensation of W excited by the X-substances remaining in the area directly affected. *This is again the positive or W after-image of W light.*²

The various statements in the above exposition need separate justification. The statement as to the immediate effects of W light on the retina, namely that it sets free the X-substances, and accelerates their action upon the nerve-endings is suggested by the series of Observations xv., xvi. and xvii. I put it forward as a working hypothesis and the evidence for its truth must be the successful application of it to the explanation of the facts throughout the rest of this paper.

It will be observed that I regard the simultaneously induced W as due to diffusion of the X-substances out of

¹ The nature of this fatigue is complex, and requires special consideration at a later stage of this exposition.

² The bright colouring of the after-images, that always in my own case follow stimulation by bright W light, I leave for consideration in a later section.

the area directly affected into the surrounding parts of the retina, and the successively induced W as due to persistence of the action of these diffused X-substances when the light rays cease to reach the retina.

The appearance of S at the borders of the patch of W light (simultaneous contrast) and of S succeeding the W in the directly-affected area (successive contrast), I regard as due to inhibition of all the cortical processes in these areas by the more intense cortical processes of the immediately adjacent areas.

Hering's well-known explanations of these phenomena may be briefly summarised as follows:—

There is in the retina a substance that may be called the W-S-substance. Dissimilation of this substance is the stimulus to the apparatus that excites the sensation of W; assimilation is the stimulus to the apparatus that excites the sensation of S. Stimulation of a retinal area by W light causes dissimilation of the W-S-substance of the area and assimilation of it in the immediately surrounding parts of the retina. Hence the appearance of a W patch surrounded by an S zone (simultaneous contrast). If the W light continues to act on the same area for a considerable period the assimilation in the surrounding parts produces so large a store of material for dissimilation that spontaneous dissimilation sets in and begins to preponderate over assimilation and the S of these parts gives place to W (simultaneous induction). If the W light-rays cease to act on the retina, this store of assimilated material in the surrounding parts continues to dissimilate, causing the appearance of the W halo (Lichthof) (successive induction), and just as the dissimilation of the area acted on by W light caused assimilation in the neighbouring areas, so this dissimilation of the region of the halo now causes assimilation in the area itself, hence the halo surrounds an S area (successive contrast). This area is the more ready to react with a preponderance of assimilation because of the previous dissimilation in it.¹

I agree then with Hering in regarding simultaneous and successive contrast as essentially similar and successive induction as a mere continuation of the processes set up by simultaneous induction, and regarding the S of the after-image as a contrast effect produced by the halo, the successively induced W light. About this last point there is no

¹ It is characteristic of the elusiveness of Hering's presentation of his scheme that I find it impossible to discover whether he regards one or other or both of these factors as essential to the production of successive contrast.

room for disagreement. If a suitable series of observations be made with increasingly bright halo, the dependence of the S on the W of the halo is obvious. It is necessary then to decide between Hering's explanations of contrast and induction and mine.

For the purpose of argument let us suppose that the contrast S is produced in the way that Hering suggests, and let us consider the production of the induced W. Prof. Götz Martius¹ has shown that there are insuperable objections to Hering's account of the processes. He points out that the induced light may continue to increase in brightness until it becomes very bright—in fact almost as bright as the inducing light—and that it is absurd to suppose this to be due in turn to the presence of excess of W-S material built up by assimilation in the same area; for if the two processes are to go on side by side in the same area a state of equilibrium between them must be reached corresponding to a brightness of low intensity. It is in fact impossible to conceive that a grey brighter than the hypothetical medium grey can be produced by such a balance of assimilation and dissimulation in the same area. Hering, in fact, would make the effect much greater than the cause.

But apart from such considerations, accurate observation suffices to show that Hering's account of the genesis of induced W light is unsatisfactory. Take the following case:—

Observation XX.—I cut out a diamond-shaped piece of S paper (this is of course dark grey only in daylight), about

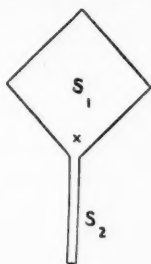


FIG. 12.

6 cm. in width with a narrow tail about $\frac{1}{2}$ cm. in breadth, S₁ and S₂ in Figure 12, and pasted it upon a large sheet of

¹ *Beiträge zur Psych. u. Philos.*, 1896. "Das Gesetz. d. Helligkeitswerthe der negativen Nachbilder," p. 74.

W paper. At a distance of about 1 metre and in bright daylight I fixated the point x and observed the changes of brightness of S_1 and S_2 . S_2 and a narrow border of S_1 about .5 cm. in width became at once S while the rest of the surface S_1 remained a dark grey undergoing no perceptible change of brightness in the first few seconds.

The blackness of S_2 and of the borders of S_1 persisted during twenty to thirty seconds and then suddenly gave way to grey, brighter than that of the centre of S_1 . S_1 now appeared as a dull grey patch brightest at its edges and less bright towards its centre. As the fixation was continued the brightness of S_2 and all of S_1 increased, but most rapidly in the centre of S_1 so that soon the whole figure became an evenly bright grey of medium intensity and so continued to increase in brightness for about five minutes. At the end of this period the difference in brightness between the S and the W paper was small. The increase of brightness seems to take place more slowly the longer the fixation has been continued, so that the brightness of the induced light seems to approach that of the inducing light asymptotically. This is the course of the phenomena whenever light is induced upon a fairly large surface and the point to which I wish to draw particular attention is this:—

The induced light appears and becomes bright upon the centre of the large area, although the centre shows no perceptible darkening through contrast in the first moments or at any other period of the fixation. Hering's theory is then quite inapplicable to such cases, for there is brightening without previous darkening, increased dissimulation without previous assimilation, and assimilation is therefore not the cause of the increased dissimulation.

On the other hand, the course of brightening and behaviour of the induced light is just such as is demanded by my hypothesis. It begins at the edge adjoining the W inducing surface and spreads slowly from this, and the longer the fixation is continued the brighter it becomes and the farther it spreads over the dark surface.

Prof. Götz Martius, in the paper to which I have already referred, describes a series of observations on what he calls "die Helligkeits-werthen der negativen Nachbilder" (the brightening value of negative after-images). He fixates a grey disc of variable brightness for twenty seconds upon a grey ground also of variable brightness; he then projects this after-image so obtained on to a second grey disc (*i.e.*, he fixates it with the same area of the retina) and determines the objective brightness that this second disc must have

in order to appear equally bright with the first. He sums up the results of these observations: "Es zeigte sich ganz allgemein dass irgend eine Helligkeit, auf einem dunkleren Grunde betrachtet, ein verdunkelendes Nachbild erzeugt, und dass umgekehrt eine Helligkeit die dunkler ist als die umgebende, ein aufhellendes Nachbild hervorbringt, welches auch die Helligkeiten seien auf welchen ein solches Nachbild gesehen wird" (p. 43). On another series of observations he bases the general law that with a grey patch on a grey ground of different brightness, the brightness of the patch and the ground approach one another (but never become equal) at a rate proportional to their difference in brightness and to the time of fixation.

Martius's most general conclusion from his observations is that after-images "selbständige, auf selbständigen physiologischen Prozessen (Nachwirkungen der photo-chemische folgen des Licht-eindrucks) beruhende psychische Erscheinungen sind, welche das normale Sehen unberührt lassen". He shows that neither the *Ermüdung Theorie* nor Hering's theory is compatible with these conclusions, and declares that a new theory of after-images is needed.

My theory of after-images, on the other hand, demands just such phenomena as are described by Götz Martius, and fits with his general conclusions. For if the phenomenon of simultaneous induction be due to diffusion of the X-substances set free, as I have suggested above, then whenever two grey surfaces adjoining one another are fixated the X-substances, being set free in greater quantity in the area of the retina affected by the brighter surface than in the other, will tend to diffuse from the one to the other until the difference is abolished. The area from which the X-substances have diffused is then relatively poorer in the mother-substances, and therefore gives a darkening (*verdunkelndes*) after-image, while the area into which they have diffused is richer in X-substances, and therefore gives a brightening (*aufhellendes*) after-image. And after-images are due to independent (*selbständige*) physiological processes for they are due to the spontaneous action on the nerve-endings of the retina of the X-substances set free during the action of the light.

To turn now to the consideration of the S produced by contrast. To my mind the assumption that dissimilation in one retinal area can determine assimilation in neighbouring areas seems very difficult to accept. How are we to conceive this interaction between different parts of the retina sometimes separated by a considerable interval? In spite of

assertions to the contrary effect, I do not think that any true physical or physiological analogy can be found for it. It cannot, therefore, be claimed that Hering's suggestion is an explanation in any true sense of the word. In my view, on the other hand, the appearance of contrast S is merely a special case of that tendency to complete fading of visual images under the inhibiting influence of brighter images which I have shown in the preceding sections to be a general law of all visual images. I have made many attempts to devise a crucial experiment that shall decide between the two suggestions, but I cannot claim to have completely succeeded; however, I submit the following as supporting mine rather than Hering's.

Observation XXI.—I laid two sheets of W paper on an S ground with parallel edges at a distance of 2 cm. apart, as in Figure 13 (a), and fixated at X for ninety seconds.

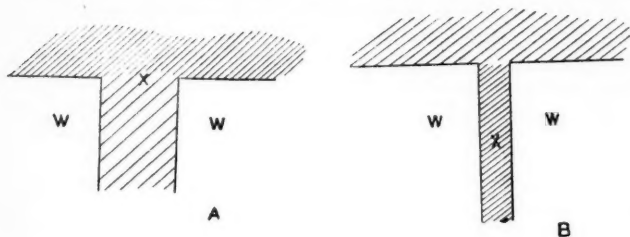


FIG. 13.

During this time there was induced on the strip of S between the W surfaces a grey of fair brightness, and on the S surface above a grey of much lower brightness. I then quickly fixated a spot 5 cm. lower down, X in Figure 13 (b), and at the same time pushed the two sheets of W paper towards one another until they were only .5 cm. apart. Then the whole strip between the two W surfaces appears quite S, i.e., the bright induced light of the lower part of the strip and the faint induced light of the upper part were equally completely abolished.

Now if we accept Hering's theory we should expect both the bright and the dull induced W light to be diminished equally in brightness by the assimilation caused by the dissimilation of the adjacent W areas, and therefore we should expect to see still a difference between the two parts of the strip. But both are quite S, as is to be expected if the abolition of the induced W is due to total inhibition of

the nervous impulses in the corresponding cortical areas. I have made many variations of this experiment which all tend to show that the darkening of contrast is not effected in any way strictly proportional to the brightness of the affected area, as should be the case if it is due to assimilation set up in a dissimilating area.

But the most nearly conclusive kind of observation is that illustrated by Figures 9 (A and B) on page 66. In such cases we see a contrast darkening of the lateral parts of each W strip, and the contrast effect is exerted by the white image of one retina upon the white image on the other. *The contrast effect, therefore, cannot be due to retinal changes in these cases but is clearly due to complete fading owing to mutual inhibition of the cortical processes excited by the two retinal images.* The supporters of the Hering theory will probably refuse to admit the force of this argument, for they will assert that in the case represented by Figure 9 (B) the W of one field, say the right field, yields at the left edge of the middle piece to the S of the left field because along this edge of the W patch it is contending not merely with the S ground of the left field but with a contrast S. And since the above was put into type it has occurred to me that the so-called yielding of W to S in the struggle of the two fields may be claimed as a support for the S-process hypothesis. It is therefore necessary to touch on this subject here. Fechner has discussed this question in an interesting manner (*Abhandl. d. sächs. Ges. d. Wissensch.*, Bd. 5). He writes that when he doubles a W patch on an S ground by regarding it with parallel visual axes, both W images maintain themselves unchanged, showing no tendency to yield to the S ground of the other field; but that when a W strip is regarded in a similar manner (so that it appears like Figure 9 (B) above), then the wings of the figure do yield to the S ground and most so at the edges of the middle piece. He asks—What is the cause of the difference in the two cases? He answers that in the latter case the W yields because it has to contend against the contrast S induced by the W of the other field.

Now I have shown in Section i. that the two images of a patch of W paper on a dark ground may and do fade completely if the fixation be sufficiently accurate (Observation xi.), and I have further shown (Observation iii.) that the fading is not due to the influence of the dark ground of the opposite field because it will occur when the W image of one field is thrown, not upon the dark ground but upon a similar W image of the other field. The greater tendency to fade shown by the wings of Figure 9 (B) is due, I submit, not to

a stronger antagonistic influence of the corresponding S area of the other field, but to the strong inhibitory influence exerted by the middle piece. For the inhibitory influence of the W of both fields is summed together in the cortical areas whose excitement yields this middle piece of the image. This is shown to be the case by the following observation—I placed two squares of W paper on a background of S paper at my interocular distance apart from one another; on regarding these with parallel visual axes they appeared as three W squares, of which the middle one was the brightest, being formed on corresponding areas of both retinæ. The lateral squares were analogous in position to the wings of figure 9 (B). They showed a less tendency to fade than the wings of this figure but a greater tendency to fade than the two images of a single W square. I then brought a narrow slip of S cardboard between the right eye and the right-hand square. The three squares now appeared equally bright and showed an equal tendency to fade, for the middle one, under these conditions, is formed on the left retina only. If now the slip of cardboard is suddenly removed the middle square brightens again and one or other or both of the lateral squares fades completely in the same moment, the image formed on both retinæ preponderates over and inhibits those formed on one only. The same thing is proved more conclusively perhaps by the following observation—I took a stereoscope provided with an object carrier that can be pushed farther from or nearer to the prisms. On to this carrier I fitted a piece of S cardboard large enough to fill the whole field of view. In the cardboard were two square apertures, each about 3 cm. in width and at such a distance apart that when the card stood at a middle distance (about 30 cm.) the image of the left hand hole in the field of the left eye appeared immediately to the left side of the image of the right hand hole in the field of the right eye, while the other two images fell outside the field of view. I fixed a large sheet of evenly bright W paper at some distance behind and parallel to the plane of the card. On looking through the prisms there was then visible only the dark ground with the two W squares upon it side by side. On sliding the card towards the prisms the two images recede from one another, while on pushing it farther from them they approach one another and then overlap more and more. The adjoining edges of the squares were made exactly parallel to one another and a tiny pinhole was made as close as possible to the middle point of each of these two edges. When the two squares stand apart with a dark band between them they appear

equally bright and show no tendency to fade. By pushing the card away from the prisms the squares can be made to approach one another until the two tiny holes coincide and form one bright spot. On accurately fixating this spot the adjoining edges of the W squares may be observed lying parallel to one another at a distance of less than 1 mm. apart. Both edges then remain sharp and bright and the whole of the squares remain as before equally and evenly bright. But if now the card be pushed out a little farther the two images begin to overlap, the overlapped edges form a brighter strip, and on either side of this bright strip appears a band of darkness shading off into the now diminished brightness of the rest of the image, exactly as in the cases described by Fechner (see Figure 9 (B)). Now if Fechner's explanation were the true one we should observe a fading of the edges of the W squares when they lie parallel to one another at a distance of 1 mm. or less, for each is then well within the zone of well-marked border-contrast and the W of either is contending against the contrast S of the other field. But instead of this we find that fading begins when (and not before) the two edges actually overlap and there is formed the image of a bright W strip on corresponding points of the two retinae. The fading of a W image then, in the binocular combination of W and S fields, is not due to any antagonistic influence of the S of the other field, but is simply a case of complete fading that is favoured by the inhibitory influence of any other W image in another part of the same or the other field, and most so by a W image that is formed on corresponding points of both fields. There is therefore no escape from the conclusion stated above in the sentence printed in italics. In this last observation I find it better to combine the fields by the use of a stereoscope rather than by fixating with parallel visual axes, because with the latter procedure the tendency of the monocular W images to fade is, in my case, inconveniently great.

Finally, if we review the various cases of inhibition of one image by another, that I have described above, it is impossible to deny that the disappearance of the positive after-image of W under the influence of a bright halo is of the same order of phenomena as the other cases of inhibition of one image by another. This is brought out most clearly if the cases be arranged in a series beginning with the inhibition of a direct image formed on one retina by a direct image on the other (Observation xi.), passing then to the case of an image on one retina inhibited by a second image at some distance on the same retina (Observation x.),

then to the inhibition of an after-image by a direct image on the same retina (Observation xiv.), then to the inhibition of one after-image by another at some distance from it on the same retina (Observation xiii.), and lastly to the case of an after-image of a sharply-bounded W patch, in which the halo and the positive after-image alternate with one another in consciousness. And I have shown above that these cases of fading under inhibition by a second image are essentially similar to complete fadings that occur without inhibition and without change in the retinal processes.

I have made many observations with coloured light that bear out my explanations of contrast and induction, but I defer the consideration of these to the second part of this paper.

There remains to be considered the alleged simultaneous contrast effect of S on W or grey. It is asserted by Hering and by Mach,¹ and it is demanded by Hering's theory. Now the most striking and the easiest way to demonstrate the contrast effect of W is by some such arrangement as this:—

Observation XXII.—I put a square of dull medium grey paper 2 cm. in width upon a sheet of W paper, and by the side of the W paper a sheet of the same grey paper. On then fixating any point between the two patches of grey at a distance of 1 metre, the smaller one on the W ground appeared very much darker than the large one. The difference is so striking and obvious that no one can fail to notice it at once.

I then substituted the S of the opening of the dark-box for the W paper, so that the small patch of grey was seen against this S ground. I could not observe any difference in brightness between the two patches of grey under these conditions. I have repeated this observation many times, varying the brightness of the grey paper used and the shape and size of the small patch, and using narrow strips of grey laid across the junction of the two backgrounds, and I have asked several other observers to give their opinion and always with the same result—the W background darkens the small grey patch very markedly; the S background produces no perceptible effect.

It would be absurd for me to assert, in contradiction of such authorities as Hering and Mach, that there is no brightening contrast effect exerted by S, but I think the above observations show that it is of a very much slighter degree than the darkening contrast effect of W. A slight

¹ Mach, *Sitzungsb. d. K. Academie, Wien*, Bd. 52.

contrast effect of the former kind is capable of being explained by my theory as due to darkening of the parts of the large grey area by mutual inhibition, and this seems to be Mach's explanation of the phenomena of this nature described by him.¹

As an example of the numerous phenomena that can be explained by my theory of induction and contrast, at least equally as well as by Hering's, I will mention the "Dunkelhof" or dark halo of Hering. When a small S patch is fixated on a W ground for about one minute and then suddenly removed, the area of W which it had covered appears brighter than the general W ground and is surrounded by a narrow zone of W or grey darker than the ground. This narrow darker zone is the "Dunkelhof" of Hering, which he accounts for as being a contrast effect of the brighter W of the area that it surrounds, *i.e.*, as due to increased assimilation caused by the increased dissimulation of the neighbouring area. On the other hand I regard it as due partly to contrast (in my sense of the word, *i.e.*, inhibition by the brighter after-image), and partly to the fact that during fixation the X-substances diffuse into the area of the retina affected by the S patch from the immediately surrounding parts, and so leave these parts relatively poorer in the X-substances.

I must consider here another class of after-image which Hering claims as a strong support to his theory.² It is the after-image obtained by a short fixation of a very bright light, as *e.g.*, by a momentary glance at the evening sun. If all light be excluded after such a short exposure to very bright light, there may be seen a bright after-image which fades slowly and continuously and may persist for some minutes. If this after-image be projected on to W paper it may and frequently does become much darker than before. Hering contrasts the behaviour of this bright after-image with that of the bright after-image obtained by fixating a black disc on a W ground. When all light is excluded the latter, like the former, appears as a bright disc fading slowly, but if it be projected upon W paper, the area on to which it is projected appears brighter than the rest of the W paper. Therefore, says Hering, there is a radical difference between the natures of the bright after-images obtained in these two ways. In the case of the former the very bright light has completely used up all the assimilation-material of the area affected, hence, afterwards, in the dark there is no assimila-

¹ Mach, *Sitzungsb. d. K. Academie, Wien*, Bd. 52.

² *Zur Lehre vom Lichtsinne*, parag. 35.

tion, but a feeble dissimilation under the influence of the inner stimuli—hence the bright positive after-image. But to do justice to this explanation it is necessary to give it in Hering's own words: "Während der Betrachtung der Sonnenscheibe findet dagegen an der direkt gereizten Stelle nicht nur eine sehr starke Dissimilierung, sondern auch eine sehr bedeutende, wenngleich minder starke Assimilierung statt; durch erstere wird die erregbare Substanz und das D-vermögen stark gemindert, durch letztere das vorhandene A-Material rasch verbraucht. Hieraus resultirt nachher im verdunkelten Auge eine Empfindung, welche auf einer nur schwachen Dissimilierung unter dem Einflusse der innern Reize und auf einer noch schwächeren Assimilierung beruht, also eine Empfindung, die zwar hell ist, aber ein sehr kleines Gewicht hat." This hypothetical state of the retina he calls one of 'assimilation-fatigue'.

Such an after-image of the sun is the brightest, most vivid, persistent and durable kind of after-image that we can ever see. How, then, is it of less 'weight' than other feebler, less durable, and less persistent after-images? It is admitted that during the fixation of the sun there must be extremely rapid dissimilation, and if a fixation of one second is sufficient to give a positive after-image of this sort (due to using up of all assimilation material) then a fixation of two, three or more seconds should use up completely the store of dissimilation material also, and the sun should cease to appear bright and its after-image should be the state of consciousness that corresponds to an absence of chemical changes in the retina. This, however, is by no means the case. The evening sun will cause a brilliant after-image of this kind if fixated for one-half, one, two three or more seconds.

Hering's explanation is then in the last degree unsatisfactory. The fact is that before the phenomena of positive after-images of all kinds Hering's theory stands helpless and hopeless. Hence the phenomena have been hustled into a corner and unfairly neglected. I have already shown that W light of all intensities causes positive after-images, except under the special conditions that determine the production of a relatively bright halo (p. 81) and in the succeeding section I shall show that coloured lights give long-continued positive (*i.e.*, same coloured and bright) after-images under suitable conditions with as great a certainty and regularity as under other conditions they give negative after-images. This incapacity of the Hering theory to deal with positive after-images is sufficient in itself to prove the theory untenable.

The following observations will make clear the true explanation of this kind of after-image:—

Observation XXIII.—I fixated the evening sun for three seconds. With closed and covered eyes the after-image appeared as a very bright disc, and when projected into the bright sunlit surface of the road at any time during the first thirty seconds it still appeared as a brighter spot on the road, but when so projected at any later time it appeared as a darker spot on the bright surface of the road, although with closed and covered eyes it still appeared as a bright disc. I repeated this many times, varying the conditions slightly, and always with similar results.

I then proceeded more accurately thus: I threw a patch of sunlight on to a plate of milk glass, let into the shutter of the dark room and fixated this very bright patch for various short periods. After each fixation I projected the very bright after-image on to a sheet of S velvet beside a sheet of W paper under a fair illumination. The after-image, as in all cases of the positive after image of W, was brighter and declined more rapidly the shorter the period of the fixation. But in every case it was at first brighter than the sheet of W paper, and declined gradually in brightness until it reached and then passed a degree of brightness equal to that of the W paper.

If it was projected upon the W paper at any time before this point in its decline was reached, it appeared on the W paper as a brighter spot and was in fact not perceptibly changed in brightness by the change of background. But if it was projected on to the W paper at any later stage of its decline, then its brightness was absolutely diminished, the change of background caused 'reversal of the after-image,' as Hering puts it.

The true explanation of these phenomena is, I submit, as follows: The intense action of the very bright light decomposes all, or almost all, the mother-substances of the X-substances that are present in the area of the retina affected and when it ceases to act leaves a large excess of the X-substances in the area. These then continue to excite the nerve-endings causing the bright after-image. This bright after-image is independent of, or but little affected by, the background upon which it is projected so long as it is brighter than that ground, but when it is less bright than the background it is darkened by contrast, that is to say, the cortical processes to which it is due are inhibited by the more intense cortical processes excited by the W background. The W after-image that follows fixation of

an S disc on a W ground, on the other hand, is due to the diffusion into that area of the retina which the disc affects of the X-substances set free in the surrounding parts, hence on projecting it on to W paper it appears always as a brighter disc because to the action of these diffused X-substances is added the action of the X-substances newly set free by the W light from the paper. In the case of the after-images of the sun the rays from the W paper cannot increase its brightness in this way because the normal store of mother-substances of the X-substances has been exhausted. The peculiarities of such after-images of intensely bright lights may therefore be said to be due to fatigue or exhaustion of the retinal mother-substances.

I have now shown that all the phenomena of contrast and induction of S and W are to be explained without the hypothesis of a special S-exciting process in the retina. So far as I know the only remaining reason for retaining the hypothesis is the assertion that mixing S with a colour diminishes its saturation just as does mixing W with it. This statement rests upon observations of the kind that is described by Müller¹ in the paper before referred to.

He prepares two composite discs of which each has a middle zone made up of 40° of R and 320° of black cloth; in one which I will call A the rest of the disc is also of black cloth, and in the other B it is of W. If these two discs be rotated side by side on the colour wheel and fixated in turn the R of the ring on A appears more saturated than the R of the ring on B. How, asks Müller, can this be explained by those who do not accept the S-process hypothesis?

In order to obtain light on this question, I made the following observation:—

Observation XXIV.—I made up two discs as follows: Disc A of black cloth with one section of W of about 90°—this on rotation appears of a light grey; and disc B of W paper with a ring of W and S in such proportion that on rotation it appeared of the same brightness as disc A in spite of the contrast darkening effect of the W ground. This required about 120° of W. Then to each ring I added 30° of R. On rotation the R of the ring on A was more saturated than that of the ring on B, and the difference was just about the same in degree as in the case of the two discs of Müller's experiment. I repeated this, varying the brightness of the grey used and also the amount of R added, and the result was always the same, thus: *e.g.*, with 20° of R and 90° of

¹ *Zeitschrift f. P. u. P. d. Sinnesorgane*, Bd. xiv., p. 135.

W in the ring of disc A, and with 20° of R and 120° of W in ring of disc B, the redness of the ring is hardly perceptible on B, but very distinct on A.

Lest any one should criticise this observation on the ground of the unequal amounts of objective W mixed with the R and S of the rings, I made one more variation of the observation.

I put 90° of W and 20° of R and 250° of S in the ring on disc A, and the same amount of W and R and S in the ring of disc B. On rotation the ring on B appeared darker, of course, than the ring on A, and the R was very distinct in the ring on A, but in the ring on B it was hardly perceptible.

(I should add that in every case the colour of the rings was observed during fixation of a point on the edge of the ring or other fixed point.)

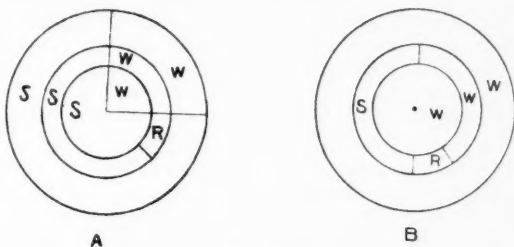


FIG. 14.

In all these cases the R was less perceptible in the ring on the W ground than in the ring on the dark ground, and in every case the grey with which the R was mixed was decidedly a light grey, lighter than the hypothetical medium grey. Addition of contrast S to such a mixture should tend to increase the saturation of the R, because it brings the grey nearer to the medium grey, but it appears that the R becomes less rather than more saturated under the influence of the W ground. This is, I believe, due to direct inhibition of the R by the R element contained in the W light of the ground. The truth of this opinion I shall attempt to prove in the second part of this paper, but however this may be it is clear that the loss of saturation of R in the rings on W ground in my observations is not due to admixture of contrast S. It is in the highest degree probable that the loss of saturation of the R in Müller's experiment and in mine is due to the same cause, and is therefore not due to

admixture of contrast S in the case of Müller's experiment as those who believe in a special S-process would have us suppose.

I have now examined all the evidence for a special S-exciting process, so far as I have been able to discover it, and have shown that no part of it is valid. I will bring this section to an end with a discussion of one or two *a priori* arguments for the existence of an S process.

Hering,¹ in putting forward the hypothesis of a special S process, represents the view that he contends against as assuming the intensest S that we can experience to be a sensation excited by the lowest degree of the process which when intense excites the sensation of bright W, and he points out how improbable this seems. There was some force in this argument when directed against Helmholtz's view of the causation of the deepest S, but it has no force if directed against my view of it. That affection of consciousness I regard as due to an occasional and fleeting inhibition of the processes in some part of the visual cortex which during all the rest of our waking life are determining some affection of consciousness. The resulting state of consciousness I regard as analogous to the consciousness of silence which we have if a long-continued sound suddenly ceases. Such an intermission of a long-continued stimulus to a sense-organ certainly determines a positive affection of consciousness. To take the stock-instance, I will refer to the miller awakened by the stopping of his wheel, or to bring the example up to date, I may recall the extraordinary effect produced in consciousness if during a long ocean voyage on a steam-ship the engines are suddenly stopped and the vibration caused by the screw ceases for a time, or again I may instance in my own case the frequently recurring consciousness of silence which I experience on leaving the roar of London for the quiet country; yet in these cases there is no reason to suppose, and I do not think that it has ever been suggested that a special physiological process determines the consciousness of silence or quiet.

Müller advances the following *a priori* argument in favour of the S process :—²

If there were no S-exciting physiological process dark objects would be dealt with as are objects whose image falls upon the blind spot, *i.e.*, the brighter areas between which the dark objects lie would appear to be continuous with one

¹ *Zur Lehre vom Lichtsinne*, parag. 27.

² *Zeitschrift f. P. u. P. d. Sinnesorgane*, vol. xiv., p. 412.

another. This is surely due to excess of zeal on behalf of the S process.

It would seem to be equally valid to argue that in the above instances of intermission of long-continued sound there must be a special process for exciting the consciousness of silence, else the sounds must appear to be continuous with one another, the intervals being neglected.

It only remains to point out that the support claimed for the hypothesis of an S-exciting process in the fact that simultaneous contrast is a process of high utility (in that it leads to the sharper definition of the outlines of the brighter areas) can equally well be claimed for the theory of simultaneous contrast set forth above.¹

¹ Of the observations recorded above some were made at Cambridge, others in my own dark room at Didsbury. During intervals of work directed to another end in the psychological institute at Göttingen I made some observations on after-images of a preliminary character, and I wish to express here my gratitude to Prof. Müller and my appreciation of the liberality with which he placed the many resources of his laboratory at my disposal.

V.—CONSCIOUSNESS, SELF-CONSCIOUSNESS AND THE SELF.

BY HENRY RUTGERS MARSHALL.

I.

§ 1. No one in these days will deny that modern progress in psychology has been determined to a large extent by the growing conviction that conscious states and neural changes flow on in parallel courses; for it is clear that the close study of neural activities, which has been stimulated largely by interest in the hypothesis of mental and neural parallelism, has thrown much light upon psychological problems.

Conspicuous among the effects of this study of mental states in conjunction with study of neural activities has been the practical abandonment of the atomistic conception of consciousness held by the earlier associationists who treated consciousness as an agglomeration of separate mental elements. As Dr. Stout has said in his *Manual of Psychology*,¹ this doctrine of association pure and simple went into bankruptcy when John Mill felt himself compelled to suggest the hypothesis of "mental chemistry".

But the most effective refutation of this atomistic form of associationism appears in connexion with our observation that the brain which is generally held to be the "organ of mind" is a neural *system*, and that consciousness also has the qualities of a system which is the coincident of the activities occurring in this neural system.

In the neural system we observe what we call elements; but at the same time we realise that they are not elements apart from the system; rather are they conditioned by being inherent parts of the system. These so-called elements we picture as somewhat akin to neural atoms which might be separable entities under other conditions; but we also recognise that they are not separable from the system of which

they form parts without a total alteration of their nature. We realise further that the system acts as a unit, so long as it is a system; and that the so-called neural elements, as they can be studied, are distinguished as being capable of becoming centres of special activity, within the system, which as a whole can but gradually be affected by the activity appearing in the parts. Nevertheless we can never conceive of the specially active neural "element" as part and parcel of the system, without also conceiving the related activity of the system, as a whole; and looking upon its activity as a unit with differentiated yet inseparable parts. The "elements" are what they are because they are inherent parts of the system: the system is what it is because it is formed of elements which under proper conditions may be the centres of newly-appearing activities of the system as a whole.

If consciousness is looked upon as a mental system coincident with the activity of a neural system, we must likewise expect to note, as we do note, what we describe as psychic "elements". Not that these psychic elements are separate entities which being bound together make up consciousness. They, as well as their neural correlates, must be looked upon as conditioned by the fact that they are inherent parts of consciousness; while consciousness as a system is conditioned by the existence of the so-called elements of which, in a sense, it is composed. Consciousness as a psychic system acts as a unit so long as it is consciousness; and the so-called psychic elements, as they can be studied, are distinguished as being capable of special mental activity, as we say, within the conscious system; which conscious system as a whole can but gradually be affected by—can but gradually assimilate—the activity appearing as the mental element. But we cannot conceive of the specially active mental element as part and parcel of the mental system, consciousness, without also conceiving the related activity of consciousness itself as a whole, nor without looking upon this consciousness as a unit with differentiated, yet inseparable parts. The mental "elements" are what they are because they are inherent parts of consciousness. Consciousness is what it is because it is formed, so to speak, of elements which under proper conditions may be the centres of newly-appearing mental qualities in consciousness as a whole, and gradually assimilating with the unit mass.

The consideration of consciousness from this standpoint has already served to elucidate many doubtful points, and to clear away many obscurities which before this conception became current stood as a bar to psychological advance. In

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the following pages I wish to consider what light is thrown upon the nature of the state which we call "self-consciousness" by the study of consciousness as a psychic system coincident with the activities of a neural system.

§ 2. When we examine consciousness in reflexion we assume a special attitude. We then become reflective and "self-conscious" as we say. In this state of mind consciousness appears always as of a dual nature; it appears as what is usually called a presentation to our ego. It is, in other words, as though a somewhat extraneous came in upon us; yet this somewhat is of consciousness itself, and for this reason, as well as for others which will appear when we consider the nature of the coincident neural activities, I have become accustomed to speak of this so-called presentation as the "increment" to the ego.

As Mr. Bradley says (*Appearance and Reality*, p. 174): "In self-consciousness a part or element, or again a general aspect or character, becomes distinct from the whole mass and stands over against the felt background. But the background is never exhausted by this object, and it never could be so."

Only in moments of reflexion, however, does this separation appear. In the vast majority of moments of conscious life this separation does not occur. During these usual moments there is but one unity and that of the Self. In other words, at such moments the Self and consciousness are identical.

The Self, when we experience a presentation, is but a part of consciousness. And this Self is itself unpresentable. It is only by an inference from the study of the moment of reflexion, in which we find an ego and its increment, that we assume that in moments when we are not self-conscious there also exists an increment to, and yet of, the Self.

That this inference is warranted I do not question, for there is felt to be no break between the moments of ordinary conscious life and the moments of reflexion; and furthermore if we assume a parallelism between neural and psychic activities, and examine the neural correlate of consciousness, we find ample evidence to warrant us in concluding that during life these neural activities form a continuum in relation to which there is constantly appearing an increment, which itself is a continuum. We are thus warranted in assuming that consciousness exists always as a unit consisting first, of the true Ego, which I speak of as the Self, which cannot itself appear as an increment in our own reflective consciousness, or in other words, which cannot be presented, although it is a part of consciousness; and

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second, of what Dr. James Ward calls the presentation continuum, which appears as an increment to this true Ego, this Self.

Under this view the condition of reflexion—of self-consciousness—is a special one in which the increment—the presentation—has a special form; in which this presentation itself consists, first, of an empirical ego (which is a part of the presentation to the true Self); and, second, of an increment (or *quasi* presentation) to this empirical ego; (which increment to the empirical ego is also a part of the presentation to the true Self).

§ 3. When we turn our attention to the study of the neural activities which appear to be coincident with consciousness, we find, as we have already seen, that these activities are systemic; and we note that while any neural system to which attention is given acts as a whole, throbs with one wave, so to speak, yet on the other hand that there are constantly developing in certain parts increments to this activity of the whole system. The brain system, as we know it, is active as a whole, yet is constantly receiving new increments of activity from various centres which are stimulated from the environment.

There is every reason to believe that these increments of activity to the whole activity of the neural system are the correlates of what we recognise in reflexion as the presentations to the empirical ego. The activity of the centres stimulated by the optic nerve for instance, appearing as an increment to the activity of the whole brain system, are coincident with the presentation which we call light.

These facts seem naturally to suggest that the activities of the mass of the neural system of which the pre-eminent part is the brain, which activities of the mass are not of the increment to the systemic neural activity of the moment;—that these activities of the mass are probably the correlates of the part of consciousness which does not appear as the presentation to the unrepresentable Self;—are the correlates of this very part of consciousness which we call the Self. Let us examine this hypothesis more in detail.

§ 4. Unless our conception of neural activities is altogether at fault, the activity of that complex neural system in man, in which the brain is the pre-eminent part, must at any special moment necessarily consist, under the normal conditions of wakeful life, first, of a mass of slight activities—of tremors if we may so speak—throughout the whole system, the result of recurrent reactions to stimuli which are past and gone; and second, of the special activity of some

inherent subordinate system, which special activity is due to some special stimulus which reaches the subordinate system at the moment under consideration from its physical environment.

This is, of course, an extremely and artificially simplified description of what happens in the nervous system which we are considering. We have in man a complex neural system made up by the integration of many minor systems, each capable under proper conditions of *quasi* separate systemic action; and these minor systems are differently constituted, their elements are differently integrated; and the minor systems are differently integrated with one another.

The activity of such a complex system of systems may perhaps be best pictured as the surfaces of a series of adjacent lakes connected by relatively narrow but unobstructed channels. The surfaces of these lakes we may picture as agitated with small waves moving in different directions, which in certain directions form combinational waves of greater amplitude. Let us suppose that these somewhat regularly agitated, and generally level, surfaces are swept by a variable wind, agitating now one part of one lake, and now another; we then have a fairly accurate picture of the activity of the pre-eminent neural system in man, during a vast proportion of the moments of life.

Let us then suppose that some great boulder rolls into one of the smaller lakes. The high waves produced by the fall of the boulder in this special lake of the lake system will gradually become effective to change the condition of surface vibration through the whole system; and to the observer the agitation of the surface of the special lake into which the boulder has rolled will appear as an increment to the agitation of the water surface of the lake system as a whole.

Consciousness, which corresponds with the neural activities thus pictured, must, under our hypothesis, consist of a mass of minor psychic activities, some of less and some of greater importance in relation to the mass of activities of the psychic system taken as a whole; to which generally active mass must be added from time to time certain increments of psychic activity.

The mass of the psychic activity as a whole is, under our hypothesis, the true Ego, the Self, which being the mass cannot itself be an increment to itself, in other words, cannot be presented; it is the mass which is often spoken of as "feeling": a word which I avoid using, so far as may be, on

account of its varied connotations and careless use in common speech. This Self is changeable in minor particulars as the result of influences from the increments received; but in the main, and relatively, it is persistent and continuous.

The increment to the mass of psychic activity at any moment is, according to this hypothesis, what we speak of as the presentation of that moment. As this increment is ever varying but continuous, so does presentation appear to us as a variable continuum.

Thus do we picture to ourselves the division of consciousness into the Self and the presentation to the Self.

But as we have already seen this Self is not of presentation, and it remains for us to consider the important attitude of reflexion in which the presentation itself appears in a dual aspect: *viz.*, as an empirical ego to which a presentation accrues as an increment.

§ 5. Let us follow the simile already used still farther. The fall of the great boulder into the small lake will form large waves upon the surface of this minor lake, which itself is already more or less agitated. It will add in the first place to the amplitude of the waves on the whole minor lake surface; but beyond that, upon this surface of increased agitation in the minor lake surface will appear higher waves due directly to the fall of the boulder. The effects of this whole higher agitation of this small lake surface will eventually be felt as an increment to the whole mass of the surface the whole lake system; but where the channels connecting the other lakes with this smaller lake are broad enough, the agitation which appears as the increment to the whole surface will indeed consist of a mass of agitation of higher amplitude than that of the surface of the rest of the whole system; but this higher amplitude will itself appear as a mass, upon which will appear the still higher waves caused by the direct fall of the boulder, which will themselves appear as an increment to the agitation of the small lake surface. In this manner the increment to the surface of the system as a whole will itself appear of a double nature; [first] as an agitation of higher degree than that of the lake system, as a whole; to which agitation of higher degree itself [second] an increment is superadded.

Consciousness, which corresponds with the neural activities thus pictured, will thus, in accordance with our hypothesis, under certain conditions, consist of a mass of minor psychic activities, the unrepresented Self; to which is added a presentation—an increment of a complex form; which increment itself will appear; [first] as a mass of psychic activity higher

in degree than the activity of the mass; and to which mass of activity itself [second] an increment of activity accrues.

Here, if our hypothesis is correct, we have a case of "Self-consciousness," in which the presentation to the unrepresentable Self appears as a complex consisting of an empirical ego to which a presentation accrues.

§ 6. The conception which I am here concerned to set forth may perhaps be presented more clearly by the substitution of another symbolic treatment for that hitherto used.

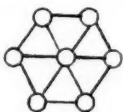


FIG. 1.

Let us suppose the above symbol to indicate, in an artificially simplified form, the activities of a neural system. If we take the circles to indicate the elements of the system, and the lines their inter-connexion, we may vary the size of the circles to indicate variations in the activity of the elements, or of the systems of which the elements are part.

Figure 1 then represents a general condition of activity in which consciousness would be but a mass of "feeling" so called. It would consist only of, and be identical with, the undifferentiated Self. This, in the nature of the case, can never be realised in our reflective experience: for the Self, though of consciousness, can never be presented.

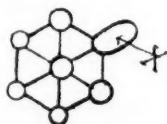


FIG. 2.

In Figure 2 we symbolise a case of normal neural activity where some one element is specially stimulated to activity. In consciousness under such conditions would appear a higher activity of the whole psychic mass than in the case above considered; in other words, we should have the whole mass, the Self, more awake; and to this more wakeful mass would appear as an increment, as a presentation, the one specially active element X.

§ 7. We thus have an explanation of presentation itself, but in terms of symbols which represent most inadequately human consciousness as we experience it. For as the brain is a neural system in which are co-ordinated minor possible neural systems, within broader systems, in indescribable complexity; so consciousness, under our hypothesis, is a psychic system in which are co-ordinated minor possible psychic systems, within broader systems, in indescribable complexity. In connection with a consideration of this high complexity of systems within systems alone do we gain an adequate symbolisation of the facts which we describe as "self-consciousness".

We may better then gain a just conception of the activity of the complex neural system in man, to which human

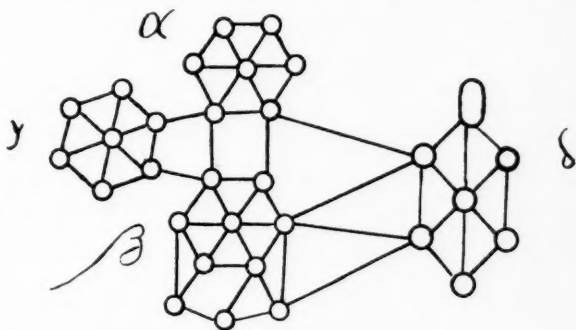


FIG. 3.

consciousness corresponds, by the use of a more complex series of symbols, which nevertheless will of necessity be most artificially simplified.

Figure 3 represents a system which is a complex of four minor systems, α , β , γ , δ . In this complex system some minor system δ is supposed to be a little more active than the rest of the total system, but so slightly more active that all parts of the system will have practically the same degree of activity. Consciousness in such a case will exist as a mere mass of "feeling," will appear to be naught but a Self; a phase of consciousness which can never appear as a presentation in reflexion, but which is nevertheless experienced; and indeed approximately grasped, dimly in such moments as those when we are dropping asleep.

In Figure 4 we represent the case where some elementary

part X of a minor system δ is raised into a relatively high degree of activity. Here we have in consciousness the mass of "feeling," *i.e.*, the Self α , β , γ , δ -X; to which is added as an increment the forceful presentation X, which is the centre of attention. Such is the psychic state when we

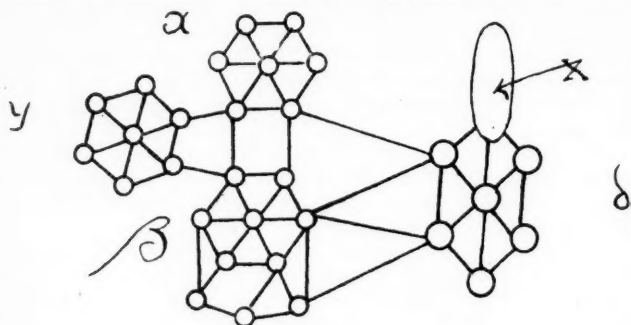


FIG. 4.

receive a sharp blow, or when we hear a sudden noise or see a flash of lightning.

But the elements of each of the minor systems α , β , γ , δ , must be supposed to be more closely bound together than are the minor systems themselves to each other; it is indeed

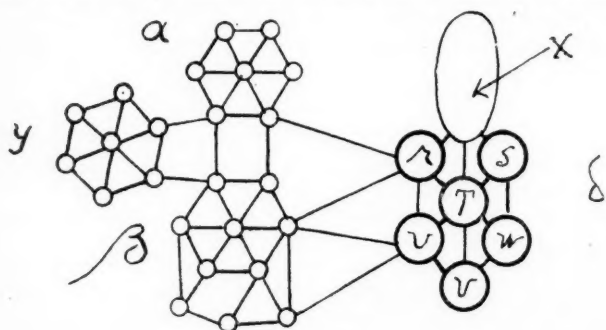


FIG. 5.

only because of this closer bond between the elements that the minor systems appear as parts in a wider complex system. Hence we should expect often to find a condition which is symbolised in Figure 5.

In this case the minor system δ as a whole will appear

as a presentation, as an increment, to the rest of the whole system of systems ($a + \beta + \gamma$).

This whole minor system δ , as presented, will occupy the field of attention, as in the preceding case did the mere element X; but in this case the presentation δ will itself appear as a mass of psychic elements ($R + S + T + U + V + W$) to which one element (X) appears as an increment.

Under this hypothesis, $a + \beta + \gamma$ represents the Self to which δ is presented; while within δ the mass $R + S + T + U + V + W$ represents the empirical ego, to which X is presented.

We have thus symbolised the reflective state which we speak of as self-consciousness, in which the presentation to the unrepresentable Self, which presentation occupies attention, appears as itself a presentation to an ego.

In the symbols above used, as I have before said, the simplification is thoroughly artificial. The systems symbolised by a, β, γ are immensely more numerous and more complex, and the system δ is itself immensely more complex. But if we allow for this weakness it seems to me that we have in this series of figures a suggestion of the basis of the general nature of consciousness as it exists in man.

Of the nature of that part of consciousness which is the true Self we can obtain no direct evidence in reflexion, for this true Self is that to which the increment is presented, and which itself can never be presented in reflexion. That the empirical ego is a presentation, or rather part of a presentation, in the moment of self-consciousness, is incontrovertible.

II.

§ 8. Of the empirical ego, and of the dependence of its characteristics upon our "projective" and "ejective" activities, as Baldwin would put it, we have no need to speak. Of the true Ego, the Self, we may perhaps say a few more words.

Although direct evidence as to the nature of the unrepresented and unrepresentable Self is not in fact given in reflexion, and under our hypothesis cannot be so given, nevertheless there is opportunity to judge in reflexion of this nature of the Self in connection with the observation of the effects produced upon the forms of presentation by the activity of this true Self. As a matter of fact, observation of these effects seems to the writer to bring into view a large amount of corroborative evidence in favour of the hypothesis

here suggested, evidence, however, which cannot be presented even in outline in an article of limits acceptable to the editors of *MIND*. A few characteristics of the Self as thus conceived may, however, be mentioned.

In the first place we may note that the Self, under this hypothesis, is a limited psychic system even as the corresponding neural system of the individual man is a limited system. Whether such a psychic system may be related to other similar psychic systems, and how it can be thus related; whether such a psychic system may be, or may under special conditions be modified to become, an element in a psychic system broader than the individual human Self; these are questions of deep interest and importance, which arise in connexion with the development of this hypothesis, but which cannot be touched upon within the limits of this article. We must turn to another consideration.

§ 9. If the hypothesis here presented is true, then as the mass of the activity in the whole neural system is fundamentally not diverse from the activity in the neural element, so the true Self is in its most fundamental nature not diverse from the presentation to this Self. The process by which the presentation is assimilated by the Self is one in which both presentation and Self are equally implicated.

As Prof. Chas. A. Strong¹ has said, "sensations and ideas . . . feelings, acts of will, and the Self as well, are all facts of conscious experience, and in this they have their being. The Self with its feelings and activities is consubstantial with all other mental facts, and is known in the same identical way—the "I" and the "know," the "I" and the "feel," the "I" and the "will," are equally facts of conscious experience."

Presentation appears from one point of view as a body of inherited "Instinct Feelings," or of those closely allied psychic states which are coincident with the expression of deeply ingrained acquired habits; over against which stands Reason as the coincident of variant activities. This conception I have discussed at length in my *Instinct and Reason*. If our hypothesis is correct, the true Self must in its nature be allied with the presented "Instinct Feelings" rather than with variant Reason.

In fact this Self can be little else than a vast bundle of "instinct feelings," which are unemphatic and unified in the mass of the Self just because they are thoroughly co-ordinated to serve certain ends, and because they act towards

¹ *Psychological Review*, vol. i., p. 76.

those ends without hesitation, *i.e.*, without that emphasis of special elementary parts which on the physical side involves variation from the forms of reaction which are typical for the organism; and which on the psychic side involves the action of what we know as intelligence and reason.

On the other hand, however, it is the Self, itself, which determines what element shall be emphasised, as it is the activity of the coincident neural system as a whole which determines what neural element shall become emphatic in the production of variation from typical organic reactions. As a stimulus coming to a neural system fails to alter the nature of the activity of the system, unless the system itself is capable of reaction to the special form of energy appearing in the stimulus, so under this hypothesis a psychic system affected by a psychic stimulus, so to speak, fails to be altered by the stimulus reaching it unless the psychic system itself, the Self, can react to the psychic stimulus—can assimilate itself to the newly-suggested forms of psychic activity.

Under this conception, moreover, the Self appears as the resultant in ourselves of the experience of the ages; its activity represents the advice of all of our countless ancestors who teach us in our own persons of the course to follow if we are to take advantage of this experience embodied in the reaction of this Self.

And if this is true the pressure from the Self should rightly have great weight in determining our actions where processes of *ratiocination* leave us in doubt. More than that they should be attentively listened to, even when they oppose trends of action or thought which appear to be thoroughly rational.

For it must be remembered that under our hypothesis the ratiocinative process is merely a special case of the general process in consciousness; a special case in which the mechanism of the process, if we may so speak, is brought more or less clearly into the field of attention. But surely there is no ground for the contention that the special form of consciousness in which reasoning appears clear is inherently nobler and more worthy of consideration than those vastly broader, although less vivid, forms of consciousness of which the Self consists, and in connexion with which the mechanism of the process cannot be brought into the field of attention.

But on the other hand the only hope of better adjustment to new conditions in our moral or physical environment lies in the possibility of variation;—in a brave modification by Reason of the forms of action inherent in the Self, and

advised by this Self, so to speak, as being accordant with the accumulated experience of each man's special ancestors through the ages past; the only hope of moral advance lies, in other words, in the development of Self government, which on its face seems to be so paradoxical, but which, under the view here maintained, is a necessary experience for one who acquires, or possesses, a capacity, voluntarily (*i.e.*, from the Self), to emphasise the processes of deliberation and reasoning which in the end tend to modify the Self, itself, and in thus modifying the Self giving it opportunity to become better fitted to do its special work in this ever-changing Universe; it is, to quote Dr. Stout¹ again, "control proceeding from the Self as a whole and determining the Self as a whole".

§ 10. As an illustration of the bearing of this conception upon psychological problems, we may consider it in relation to the problem of the relation of Belief and Will which has been brought into prominence by the publication of Dr. James' "Will to Believe". The doctrine there maintained briefly stated is this: "Our passional nature not only lawfully may, but must, decide an option between propositions whenever it is a genuine option that cannot by its nature be decided on intellectual grounds; for to say, under such circumstances, 'Do not decide but leave the question open' is itself a passional decision, just like deciding yes or no, and is attended with the same risk of losing the truth".

This doctrine has aroused much opposition, notably on the ground, as Mr. Dickens S. Miller puts it,² "that such precepts are in effect an attempt to corrupt intelligence, that they aim a deadly blow at the vital instincts of the upright intellect". Here we have Prof. James upholding the view (to use Mr. Miller's words) that "belief is always, because in essence, a matter of the will". On the other hand, we have his opponents holding that belief "is of an essence altogether distinct from will".

In the first place then we have to consider a question of fact. As I have elsewhere argued³ it seems clear that we always must exert our will whenever we believe: that belief implies a judgment, and that judgment involves a voluntary act: that settled conditions of mind which are often objectively interpreted as belief, are, or may be, conditions of belief, but are not belief proper. We are wont to say, for

¹ *Manual of Psychology*, p. 615.

² *International Journal of Ethics*, Jan. 7, 1899, p. 172.

³ *International Journal of Ethics*, April, 1899.

instance, that the common man believes in the reality of objects in the outer world, because he acts as if he believed; but in truth the conditions of belief alone obtain in such cases. He cannot rightly be said to believe in the reality of these objects until doubt as to their reality, such as has never been raised, is raised in his mind; and then only is it that by an act of will, from within, as we say, his Self casts aside the doubt, resolves the deadlock, and he believes.

This is true even where we act "as if we believe". In such cases it seems to me that in the moment when we act "as if we believed," *in the moment of the act*, we must, and do, believe as we act. In the immediately following moment we may say, "I do not believe," or, "I know not whether to believe or to disbelieve"; but at the moment of the act, belief was bound up in, as an inherent part of, the act.

Now strange as it may appear, I am convinced that the very men who deny this to be a fact—careful and honest thinkers though they be—are actually proving the validity of the position here upheld in the very denial they make. What is it that arouses their objection to believing that the Self may properly influence belief? They deny this plain fact because they think it an attempt to corrupt the intellect. It is because such a doctrine runs counter to the whole present trend of their thought, and because, in their view, it would, if true, weaken their foothold as philosophers and their morals as practical men. They therefore, in taking this very position, cast aside the doubt raised by James's suggestive essay; they "will to believe" that the doctrine is untrue. Whether it turns out to be true or not is not now to the point; the fact to be noted is that they have not as yet proved it untrue. Nevertheless, pending the refutation, which they hold must be forthcoming but which they cannot present, they "will to believe" that it is not true for them.

If then we grant that belief is essentially an act of volition, we perceive that in all cases of willing to believe the process is the same, and that it consists in the appearance from within the Self of some influence which constrains us to resolve in some one direction the conscious opposition involved in doubt. It is not from without, but from within, the Self that proceeds the power to "load the dice".

This, however, does not involve a doctrine of "contingent choice"; it involves no claim that the "dice are loaded" by processes which do not conform to psychological laws. If I am correct in my view as stated above,¹ the Self which

¹ Cf. also my *Instinct and Reason*.

"loads the dice" (if I may repeat myself) is but a huge bundle of instincts; or to state it more correctly, it is the psychic correspondent of a complex instinctive system which throbs as a unit, but which is not differentiated by the excessive or emphatic partial activity of any part of the complex system; it is the mass of "feeling" so called by many; it is that part of the moment's conscious experience which we are warranted in describing as the field of inattention.

When, therefore, there arises from within this complex system an influence which determines an act of will, this influence is due to the existence of instinctive tendencies of the most fundamental character, of the most complete co-ordination, which act without telling us (by attracting our attention) that they are acting, or are going to act. This silent Self, this throbbing, pulsating mass of inattention, is the resultant of our inheritance from the ages, and of only a relatively small increment due to our own experience in this life. It speaks of the experience of all our ancestors; of those who were men, and of that long line of living forms from whom the first of human beings were descended. These racial experiences have impressed upon us apperceptive systems, and impulse series, in which certain forms are implicit. When some new conception presents itself to us in which this form is explicit, then it is that the Self acts: it stands ready to assimilate this new conception, and when question is raised as to its reality, this Self "loads the dice" in favour of the new conception. The existence of this form in the Self thus determines the reality of the conception, its relative permanence; and the conception thus becomes real for us through the influence of the Self.

As I have said above, the Self speaks of the experience of all our ancestors, of those who were men, and of man's long line of progenitors of diverse animal forms. It speaks with impressive force the voice of this racial experience. If it breaks down a hesitancy, a doubt, by determining an act of will, it, in that very fact, raises objections from racial experience to the notion which is overthrown in the willing to believe. This Self says to us: "The elements which are present in the fields of attentive consciousness represent but a paltry array of experiential effects; I who am the resultant of the experience of the ages judge that the belief which is appearing in the field of attention, but which I overthrow, has a dangerous outcome. It may be impossible to present my objection in the field of attention in ratiocinative form, but my experience from the vast aeons of time leads me to

see that the reality, the truth, is on my side; that the statement of the truth emphasised by reason, and which appears in the field of attention, must be modified if it is to accord with this reality of racial experience. This reality is expressed in my act of will, and the doubt, if it recur and persist, should merely serve to emphasise the necessity of this restatement, so that my act of will may appear to accord with the outcome of ratiocinative process."

VI.—DISCUSSIONS.

EXPERIMENTATION ON EMOTION.

It appears to me that the experiments which Prof. C. S. Sherrington adduces under the above title in *Nature* (2nd August, 1900), in order to overthrow Prof. William James's hypothesis of the nature of emotion, fail entirely to accomplish the object he has in view. For the benefit of those who have not read Prof. Sherrington's interesting paper, I will first briefly recapitulate the position.

Two factors are given: one, the emotional condition of the mind, the other, the contractions of skeletal or visceral muscles producing emotional expression. The problem is concerned with the order of the connexion between these two factors, between emotional feeling and emotional expression. Is emotional expression determined by or does it determine emotional feeling, or are the two collateral and concurrent?

Prof. James¹ is doubtless the ablest exponent of the view that the feeling of emotion is determined by the muscular movements of emotional expression. He says: "An object falls on a sense organ, affects a cortical part, and is perceived; or else the latter, excited inwardly, gives rise to an idea of the same object. Quick as a flash, the reflex currents pass down through their preordained channels, alter the condition of muscle, skin and viscus; and *these alterations*, perceived, like the original object, in as many portions of the cortex, combine with it in consciousness and transform it from an object-simply-apprehended into an object-emotionally-felt."

Now Prof. Sherrington's experiments consist in preventing *these alterations* of muscle, skin and viscus from being experienced by the animal; for this purpose he makes the animal almost wholly anæsthetic. He then still observes certain movements of expression and concludes that the animal still feels the corresponding emotions. Hence to his mind, Prof. James's hypothesis becomes untenable. Prof. Sherrington selected a dog of "markedly emotional temperament". By "appropriate spinal and vagal transection," he cut "from connexion with the organs of consciousness the whole of the circulatory apparatus of the body," and removed "the sensation of the viscera and of all the skin

¹ *The Principles of Psychology*, by William James, vol. ii., chap. xxv. London, 1891.

and muscles below the shoulder". "The reduction of the field of sensation," so obtained, caused "no obvious diminution or change of her emotional character." Her anger, joy, disgust and fear remained as evident upon provocation as before. Even when hungry, she refused to eat a plate of dog's meat, showing conflicting emotions of "desire and disgust" in spite of every encouragement given her that she might eat. From these observations the conclusion is drawn that sensations or presentations arising from the muscular activity of emotional expression are not necessary for the development of emotional feeling.

Now Prof. Sherrington, strange as it may seem, appears not to see that all these above-described antics of joy and grief may be performed by a dog who remains throughout incapable of feeling its expressed emotion. Even if it is legitimate to allow the feeling of emotion in a normal dog excited by normal influences, is it not going altogether beyond our tether to assume that a dog, whenever it shows an emotional expression, must necessarily feel the corresponding emotion? An animal may be anæsthetised or not, its cerebral cortex may be present or removed; yet appropriate stimuli will cause its tail to wag, its ears to lie back, its pupils to dilate or its hair to stand erect—all without proof of the accompaniment of the appropriate psychical factor of emotion.

What then is required to prove or disprove Prof. James's theory? The latter himself tells us: "A positive proof of the theory would . . . be given if we could find a subject absolutely anæsthetic, inside and out, but not paralytic, so that emotion-inspiring objects might evoke the usual bodily expressions from him, but who, *on being consulted*, should say that no subjective emotional affection was felt". Unfortunately the dog of Prof. Sherrington's experiments cannot give us this essential information. And so Prof. James's hypothesis remains unaffected.

CHARLES S. MYERS.

VII.—CRITICAL NOTICES.

Les Grands Philosophes.—Kant. Par THÉODORE RUYSSSEN, Agrégé de Philosophie, Professeur au Lycée Gay-Lussac (Limoges). Paris: Félix Alcan, 1900. Pp. xi., 391.

M. RUYSSSEN has undertaken a difficult task, and has achieved it successfully. He has sought to set forth, in a volume of moderate size, the whole philosophy of Kant, and he has guarded against the almost inevitable indefiniteness of so wide an exposition in so small a space by using for the most part Kant's own words. M. Ruyssen endeavours, as far as possible, to avoid discussion about points of interpretation, and thus separates himself from the more scholastic commentators on Kant, while he also bars himself from the method of another set of expositors by declining to make any estimate of the specific value of Kant's system or to show its historical significance. It is not that he is without opinions on these matters or that he minimises their importance; but he sees clearly that within the limits of his book he has quite enough to do in making a summary statement of Kant's leading arguments. M. Ruyssen's work may thus in many respects be compared with Prof. Watson's *Selections from Kant*, although it seeks to cover a much wider ground and not merely selects but condenses the selections. The task of both writers was most useful, but by no means easy. Kant, with his elaborations and repetitions, gains greatly, from the reader's point of view, by condensation and selection. But his repetitions are seldom mere repetitions, and, therefore, it is not easy to select; while his elaborations often suggest problems of interpretation, so that it becomes somewhat perilous to condense. In any case it is a great gain to have French clearness and method applied to the system of Kant by so careful a scholar as M. Ruyssen.

The main line of interpretation which M. Ruyssen follows is much the same as that laid down by Paulsen, in opposition to the views of Schopenhauer, Benno Erdmann and others, whose contention is that the lesson of Kant means the renunciation of all metaphysics as beyond the power of human reason, which can never reach the thing-in-itself. M. Ruyssen's view is that Kant endeavoured to establish the validity both of positive science and of metaphysics, his two unshaken convictions being (1) belief in science and (2) moral faith. "L'intention maîtresse de Kant est . . . d'isoler si radicale-

ment science et croyance métaphysique, que ni celle-ci n'ait rien à redouter des conclusions de la première, ni celle-là rien à craindre de l'incertitude expérimentale et rationnelle de la seconde" (p. 67). As regards Kant's intention this seems a perfectly sound position, and it is one which the pure expositor of Kant ought certainly to take. If, however, we ask how far Kant was successful in carrying out his intention, or (what is much the same) if we try to estimate the historical value and significance of Kant's system in relation to others, we may be entitled to proceed upon other lines of interpretation. Every exposition (however much it approaches to being literal) is to some extent a reconstruction, and, therefore, the main characteristics of the interpretation depend to a great extent upon the purpose of the expositor. M. Ruyssen's intention is to give "an inner history of the philosophy of Kant," and accordingly one cannot blame him for dealing with the Kantian system almost as if it stood in isolation, while one is bound to commend the self-restraint with which he limits his criticism "aux discussions indispensables pour atténuer quelques contradictions apparentes ou mettre en lumière certaines transitions peu visibles entre les parties d'un système essentiellement continu et progressif" (p. x.).

This continuity in the development of Kant's system is well brought out by M. Ruyssen. He insists very forcibly on the unity of the critical philosophy, in spirit, in method, and in doctrine, throughout the whole of its range. While recognising certain definite stages in the progress of Kant's thought, he thinks it wrong to regard these as marking fundamental changes of view. Suggestions of the critical philosophy abound in the writings of the pre-critical stage, and one cannot read, for instance, the *Träume eines Geistersehers*, without being struck by such phrases as that (quoted by M. Ruyssen) which requires metaphysics to be "a science of the limits of human reason," and by the equally remarkable references to the independent certainty of "moral faith". Kant never really adopted an empirical or sceptical position. "A mesure qu'il s'éloigne de la grande route frayée par Descartes et Leibniz pour se rapprocher de l'empirisme sensualiste de Hume et de l'empirisme morale de Rousseau, Kant pose les jalons du chemin nouveau qu'il tracera lui-même" (p. 53). Further, M. Ruyssen, while following in his exposition the second edition of the *K. d. r. V.*, does not regard the differences between the editions as indicating any fundamental changes in Kant's thought, and in the same way he insists on the essential unity of the three *Critiques* with one another and with *Religion within the Limits of Pure Reason*. "Pas plus qu'entre la *Critique de la raison pure* et celle de la *raison pratique* il n'y a solution de continuité entre celle de la *faculté de juger* et les deux précédentes. Elles s'harmonisent par l'unité de leur méthode et l'identité de leurs résultats" (p. 325).

The opening chapter of M. Ruyssen's book is devoted to a brief

but clearly-written biography of Kant, and this is followed by a careful and scholarly account of his various pre-critical writings, which are divided into three groups, those on Natural Philosophy, those on Metaphysics, and those belonging to the empiricist stage of his progress. As the result of his thinking during this period Kant obtained three fundamental ideas which he never afterwards gave up: (1) belief in the certainty of science; (2) the distinction between the analytic and the synthetic procedure of human thought and the conviction that the former, founded on the principle of identity, connects ideas only and not things, that a purely deductive metaphysic or science does not reach reality, that every objectively true judgment is a synthesis founded on experience; (3) the independence and primacy of moral feeling, which feeling philosophy ought doubtless to justify, but which it can neither create nor destroy (pp. 53, 54). Chapter iii. is devoted to an exposition of the *K. d. r. V.*, along with the relevant portions of the inaugural dissertation of 1770 (on the principles of the worlds of sense and understanding) and the *Prolegomena*. If it be granted that it is possible to accomplish this in ninety-four pages, the work is very well done; but it will be more useful to a reader already familiar with Kant, and desiring merely a convenient abstract of the *Critique*, than to one who wishes to obtain a knowledge of Kant's philosophy in an untechnical form. The difficulty of reading Kant, which M. Ruysen wittily describes, is nowhere greater than in this *Critique*, and consequently the disadvantages of his method of interpretation are specially evident here. Kant certainly repeats himself in a tiresome way, but his repetition is generally with a difference, and we can seldom find one statement which adequately expresses his thought. Consequently, a "skipping" method of exposition, which aims at giving mainly Kant's own words, is apt to increase difficulties rather than lessen them. On the other hand, such an exposition as this may be of considerable value to one who reads it along with the text of the *Critique*. I have noted several passages in this chapter which are specially open to the objections which I have suggested. The account (p. 105) of Kant's attempt, in the second edition of the *Critique*, to prove a necessary existence outside of us from the consciousness of our own existence, seems to me to give the argument in a form which is not complete enough to be conclusive. Again, M. Ruysen's brief statement regarding the origin of the three great proofs of the existence of God is practically quoted from Kant's own summary of his argument; and yet it cannot be said to be clear or sufficient by itself. Another instance of similar inadequacy occurs in the exposition of "The Discipline of Pure Reason in Relation to Proofs" (*K. d. r. V.*—Ha 589), where M. Ruysen says (p. 152): "La possibilité de l'expérience demeure l'unique critérium légitime d'une démonstration philosophique. L'unique preuve du principe de causalité, par exemple, est la nécessité d'une détermination dans le temps pour qu'une expérience

se produire." That is perfectly true so far as it goes; but Kant's point is not merely that experience is impossible without determination in time, but that determination in time is impossible apart from the law of causality. "The determination of an event in time, and consequently the event itself as belonging to experience, would be impossible if the event did not come under this dynamical law" (*K. d. r. V.*, *loc. cit.*). This, of course, is a small matter, and it may be that M. Ruyssen regards the omitted point as so self-evident that it does not need to be stated; but I am inclined to think that the passage will not be clear to the majority of his readers.

Apart from this feeling that, probably owing to the exigencies of M. Ruyssen's method, the *K. d. r. V.* has hardly received full justice, one can have little but praise for the way in which the work has been executed. Chapter iv., dealing with the "Metaphysic of Nature," is one of the most interesting and valuable in the book. M. Ruyssen has made full use of the recent commentaries by Arnoldt and Heinze upon Pölitiz's edition of the notes of Kant's lectures on metaphysics and the philosophy of religion. In reading this chapter I have been much impressed by the resemblances (though, of course, accompanied by many differences) between Kant's suggestions of a metaphysic of nature and the views of the real Leibniz, as distinct from the Wolfian Leibniz whom Kant had thrown over. It would be interesting to have this fully discussed; but the inquiry would carry us away from M. Ruyssen's book.

Kant's ethical doctrine is expounded in chapters v. and vi. Chapter v. consists mainly of a summary exposition of the *Kritik d. prakt. Vernunft* and the *Grundlegung d. Metaph. d. Sitten*, the two being skilfully combined into a clear and continuous statement, in which, as far as possible, Kant's own expressions are used. Occasionally, as in the case of the *K. d. r. V.*, the exposition is too brief to be adequate; but the deficiency is here less noteworthy and on the whole the statement is admirable. The real difference underlying the superficial resemblance between the ethical positions of Rousseau and of Kant is admirably brought out in a brief comparison between them; and in chapter vi. their views on Education are similarly contrasted. The main subject of chapter vi. is an exposition of the *Metaph. Anfangsgründe d. Rechtslehre* and *d. Tugendlehre*, while some account is also given of various other writings, mostly on the philosophy of history and anthropology. *Der Ewige Friede* and the lecture-notes on Education are also expounded with some fulness in Appendices. M. Ruyssen refuses to regard the former of these as a mere humanitarian dream or (as Stengel and others have recently suggested) as a piece of ironical humour. "Il y faut voir l'espérance d'un ferme esprit qui n'ignore rien des dures conditions de l'enfement humain et croit que l'avenir, pour être d'ailleurs élaboré par le passé, peut cependant devenir meilleur et plus doux" (pp. 241,

242). In this M. Ruyssen is doubtless right; but one cannot but wish that he had given to the fuller exposition of the *K. d. r. V.* some of the space which is here devoted to the *Rechtslehre* and the *Ewige Friede*.

In chapter vii. the *Critique of Judgment* is expounded and its history is traced in Kant's letters. On Kant's own avowal it was not a part of his original plan; but on the other hand Kant vigorously maintains that the logic of the system inevitably leads to it. Little need be said of the exposition, except that it is carefully done, on the same principles as the other parts of the book, and that its clearness is enhanced by an occasional variation in the order of the parts. As to the relations of the three *Critiques*, M. Ruyssen, as we have seen, maintains that they are one in method and identical in their results. The *Critique of Judgment* does not solve, but rather emphasises, the dualism between nature and freedom. Yet "elle les a en quelque sorte rapprochées. . . . Sans amoindrir le domaine de la connaissance, elle élargit l'empire idéal de la liberté et rehausse encore la primauté de la raison pratique; car elle montre, avec plus de précision encore que la *Critique de la raison pratique*, que le beau, l'harmonieux, le divin même n'ont de sens qu'en raison du moral" (p. 326). This is not altogether a satisfactory conclusion in itself; and yet one cannot deny that it is a legitimate interpretation of Kant.

Kant's philosophy of religion is the subject of chapter viii., which opens with an interesting account of the position of the question in the eighteenth century. There are two main problems, that of evil and that of the relations between faith and reason. As to the former of these M. Ruyssen finds in Hume's *Dialogues on Natural Religion* the influence which detached Kant from the optimism of his earlier years—an optimism derived from Leibniz and Wolff. As regards the question of faith and reason the main historic influences on Kant's mind were, on the one hand, the orthodoxy of pietism and, on the other hand, the rationalism springing from Leibniz and Wolff and passing to Reimar, Lessing and Herder. From this historical statement M. Ruyssen proceeds to an exposition of the *Religion within the Limits of Pure Reason*, which he interprets as the Kantian solution of the problems of optimism and pessimism, orthodoxy and rationalism, and the chapter concludes with a general summary of Kant's theological position, in course of which the remarkable resemblance between his view and that of Lessing in *Nathan der Weise* is pointed out.

In a few concluding pages M. Ruyssen notes some of the chief features of Kant's philosophy as a whole. "Il fut vraiment, durant quarante ans, le cœur vivant de l'Allemagne pensante, rendant plus pur et plus chaud à ce grand corps tout le sang qu'il en avait reçu" (p. 360). While the most striking characteristic of the system is its richness and variety, its fundamental unity is none the less remarkable, and the diversity of the systems arising out of Kant's philosophy is, according to M. Ruyssen, due to the compre-

hensiveness of his method and the variety in the points of view of his disciples, rather than to internal contradictions in the system itself. That is, it seems to me, a somewhat doubtful proposition; but M. Ruyssen is on surer ground when he maintains that at any rate for Kant himself there was no contradiction: his position was, in his own view, the same from beginning to end.

The book is furnished with a useful chronological table and a well-chosen bibliography and it is throughout an able and scholarly piece of work.

R. LATTA.

La Tristesse et la Joie. Par GEORGES DUMAS, Docteur en Médecine et Docteur ès Lettres. Paris: F. Alcan, 1900. Pp. 426. Price 7 fr. 50.

THIS is the first of a series of monographs in which the author proposes to discuss all the special emotions. It is greatly to be hoped that he may succeed in fulfilling this plan, for the first instalment is distinguished above all other works on the subject by the absence of rhetorical description, by careful workmanship, and by clear consciousness of method. If in places the general theory is somewhat halting, it must be remembered that the author's decisions are in part provisional only, and subject to correction and expansion in later volumes.

Many writers have founded their analysis of emotions upon a comparison of numerous individual cases. This procedure is simple, but dangerous; it can give only average results. The surer way is to study different emotions in the same individual, and that is most easily done in pathological cases. It may, of course, be argued that we cannot conclude from the abnormal to the normal; but Dr. Dumas justly maintains that the disproportion of morbid emotion to its cause and its unusual duration are alike external to its purely affective character, whilst the intensity of physical concomitants differs from the normal only in degree. His general outline of procedure settled, Dr. Dumas discusses two preliminary questions. First, he follows MM. Raymond and Janet in drawing a distinction of great importance between 'emotion-shock' and 'emotion-sentiment'. Secondly, he examines the current views on 'physical' pleasure and pain, coming to the conclusions (1) that if pain is at first merely a sign of over-excitation and parallel to physiological concomitants, it can later itself determine organic changes, and (2) that we must distinguish between active and passive types of reactions to pain, the difference between them being from a purely external point of view greater than that between the active type and the reactions to pleasure. This distinction to types is fundamental for the ensuing discussion, and is undoubtedly valuable. It would, however, have gained in

clearness had the author explained his position with regard to the demarcation of pain proper (*Schmerz*) from 'unpleasure' (*Unlust*). The French language seems at this point to suffer from the same lack of terms as our own.

To his next step the author makes essential the identity in quality of all pleasures and of their opposites. On this point it would be time wasted to argue, for argument on either side becomes mere assertion. It can only be said that the view upheld by Dr. Dumas and so many other writers contradicts ordinary experience, and fails to give any reasons why pleasures, just like colours, should not as such differ in quality; and such a difference would not really invalidate the general arguments as to the conditions of feeling to which we shall come shortly.

Just as in the simple feelings, so also in the more complex affective states we must distinguish a passive and an active type. The passive type of morbid sadness is characterised psychologically, (1) by the absence of 'moral pain'; (2) by a general feeling of physical impotence and a painful cœnæsthesia, these constituting the affective element; (3) by real mental impotence; (4) by 'diminution in the life of relation,' i.e. want of interest in surroundings and tendency to isolation. The active type agrees in the last three points, but is distinguished by the presence of 'moral pain' or suffering and by delirium due to and again reacting on this suffering. In joyfulness also an active and a passive type may be distinguished, marked respectively by presence or absence of 'moral pleasure,' but the types run into and occasion one another, and are less noticeably different than in the case of sadness. In general, the characteristics of morbid joy are (1) a general feeling of well-being and power, with altruistic tendencies; (2) real mental power; and if (3) 'moral pleasure' is felt, it excites (4) representations which react upon it and are influenced by psychical activity and the cœnæsthesia; (5) there is also desire of action and of social life, and (6) a tendency to inco-ordination which grows with the intensity of the emotion. The chapters that describe these states are full of interest, but it is impossible to note more than one or two points here. One point is the condition of attention: both in passive melancholy and in intense joy it is 'atrophied,' but whilst in the former it is so weakened as scarcely to exist, in the latter it is so volatile as to be almost useless, being directed '*à tout et à rien*'. This inability to maintain fixed attention in joy is evidence that the increase in sense-acuity, the vivacity of imagination, and the like, are due to true hyperæsthesia; and similarly it is probable that in passive sadness the sensibility is really lessened, though here decisive proof is scarcely to be attained.

Of the psycho-physiological chapter it must suffice to give the main conclusions. Every emotion-shock is accompanied by (1) cerebral vaso-dilatation and peripheral vaso-constriction; (2) cardiac acceleration and arterial hypertension, and (3) respiratory accelera-

tion. With the emotion-sentiments matters are more complicated. Passive sadness is marked by weakened peripheral circulation, slow heart-beat and slow respiration, whilst the active type displays an active circulation and accelerated heart-beat and breath. Now, the characteristics of joy are precisely the same as those of active melancholy, except that in the latter case the excitation is '*une excitation de déprimé*,'—i.e., the heart-beat, though quick, is weak and the respiration shallow—just as, psychologically, the active reactions of sadness are not a true revolt, like anger, but '*une révolte de faible*'. In spite of this difference it is evident that Dr. Dumas's results work powerfully against the sensational theory of emotion, to an extent, indeed, that Dr. Dumas himself scarcely appreciates.

The chapters on 'Psychochimie' and 'Psychophysique,' dealing chiefly with nutrition, weight and temperature of the body, give no unexpected results; in that on 'Psychomécanique' it is worth noting that according to Dr. Dumas the increase and decrease of muscular force in joy and sadness respectively affect movements of extension and movements of flexion alike. This is certainly what one would expect, but it is in opposition both to Münsterberg's results and to the exactly opposite results of other writers, with whom Dr. Dumas does not seem to be acquainted. It is unfortunate that his experiments are so few in number.

Turning now to Dr. Dumas's theory of the conditions and nature of joy and sadness, we learn that the latter goes with the exhaustion of associative functions or the arrest, partial or entire, of habitual and instinctive tendencies. Just as exhaustion is at the bottom of bodily pain, being there due to overexcitation, so too it is fundamental to all kinds of sadness. Joyfulness, on the other hand, goes with moderate stimulation of mental functions and with increased liberty and scope for representative and other habits and tendencies. The presence of excitement, painful or pleasant, is conditioned by the temperament of the individual; the active type reacts more freely because it feels more keenly. Physiologically, the simpler, passive feelings are due, in the case of sadness, to functional arrest and consequent anaemia of the centres, or to an exhausting excitation, determining phenomena of resistance; and, in that of joy, to moderate stimulation with consequent hyperaemia of the centres, the excitation sometimes determining marked reactions.

But what are we to say of the nature of these emotions? Dr. Dumas expounds his view in the light of sensational theories, and his position, though scarcely more than provisional, cannot be called satisfactory. Lange's doctrine he discards, but with that of James he dallies in very inconclusive fashion. His whole line of investigation and especially, perhaps, the fact that he has succeeded in modifying the affective state of his patients by means of drugs leads him to attach great importance to organic conditions; but it is disappointing to find that he has taken no notice of

Stumpf's weighty criticisms of the sensational theory (*Zeitschrift f. Psych.*, xxi., 47). The actual conclusions reached are wavering, if not inconsistent. For the passive types of emotion James' peripheral theory is held to be probably true, but "pleasure and pain in their acute forms are not the effect but the cause of the majority of the peripheral reactions which characterise exuberant grief and joy," and in the active types a central 'sensation' of pleasure and pain is the starting point. This so-called sensation can scarcely be peripheral, not only because we localise moral pleasure and pain in the anterior part of the brain (surely a disputable statement), but more especially because extreme moral pain can occur without any facial reaction. Dr. Dumas therefore reserves judgment, displaying the same kind of inconsistency as that which James displayed in the case of the finer emotions. If pleasures are always qualitatively identical, and pains also, whether bodily or moral, then it is difficult to avoid referring them to the same origin, and surely the passive types of emotion are pleasant and unpleasant in their own degree. If they are, we might derive the feeling of depression, for example, from peripheral sensations, but not the hedonic tone; and if the impossible position were to be maintained that the passive types are toned neutrally or not at all, then it was incumbent upon Dr. Dumas to insert a preliminary discussion of other simple feelings than pleasure and pain. The confusion is largely due to the unquestioning identification of pain and 'unpleasure'; the tone of passive sadness is overlooked because it is not acutely painful. Perhaps Dr. Dumas will make his position more secure in his next work; it is to be hoped, however, that he will find some less equivocal and dangerous name than the "theory of 'cerebral cœnæsthesis'" for the non-peripheral view. Either an index or at least a subdivision of the long chapters into paragraphs with titles would greatly increase the convenience of his work.

T. LOVEDAY.

VIII.—NEW BOOKS.

Manual of Psychology. By G. F. STOUT, M.A., LL.D. London: University Correspondence College Press, 1899. Pp. xvi., 643.

THE present reviewer, who feels that he owes an abject apology, alike to the Editor and the readers of MIND for the lateness of the accompanying notice, has little hesitation in pronouncing Dr. Stout's *Manual* on the whole far and away the best text-book of Psychology for teaching purposes with which he is acquainted. Among the German Psychologies the admirable *Lehrbuch* of Beneke seems to him to present most points of similarity with Dr. Stout's work, though it labours under the disadvantage of a difficult style, besides being by now somewhat antiquated in its facts, and has never attracted the attention its merits deserve. In English the most serious rival of Dr. Stout's *Manual* as a work at once clear enough to attract the beginner and full enough to provide for all the ordinary wants of the more advanced student is probably the translation of Höfding's *Psychologie*, which is however seriously vitiated by the author's excessive weakness for the formulae and analyses of Associationism. Among the many merits of the new *Manual* there are two in particular which seem to call for special commendation, the combination of the genetic with the analytic standpoint as the basis of the arrangement of the material and the complete rejection of the old Associationist or Humian analysis of the contents of mind. The matter of Psychology becomes infinitely easier of assimilation when well-marked concrete stages in the development of mental life, such as the sensational, the perceptual, and the ideational stages, are successively dealt with as concrete wholes. The analytical arrangement of such works as the *Outlines* of Sully and Höfding, in which the development of cognition, feeling and volition is described separately, inevitably tends to obscure the identical character of the evolution which is being dealt with from the three points of view and to perpetuate, at least in the mind of the beginner, the notion that he is being introduced to three distinct "faculties" or classes of mental states. With Dr. Stout's arrangement, according to which the feeling-tone and conative aspect of each level of mental development are separately treated in immediate connexion with the corresponding cognitive aspect, such a mistake should be impossible to even the dullest pupil. The second point is one of still greater importance, and constitutes the most original feature of the book. It is an immense gain to have adequate views as to the nature of perception, and the character and function of "ideas" put clearly before the student from the first in the place of the crude Humian assumptions of most of our elementary text-books. And students who are by no means beginners will find the grounds for rejecting the Associationist account of perception already brought forward in the author's *Analytic Psychology* restated in the present work with added force and lucidity. With a view to a second edition it might perhaps be suggested that the beginner at

least is apt to find difficulties in the notion of a psychological "disposition" and its relation to modifications of physiological structure which might be removed by a few added lines of explanation. Among minor excellences may be mentioned Dr. Stout's laudable abstention from encumbering his pages with numerical results of experiment which as yet have thrown no light upon questions of principle. The temptation to give Psychology a spurious air of scientific exactitude by the free use of mere figures is just now a serious one, and much credit is due to a writer who successfully resists it.

The one chapter in the book which the present writer has, after repeated perusal, found obscure and unsatisfactory is that on "Body and Mind". The impression that chapter has left on one reader at any rate is that it says either too much or too little—too much to be accepted as an account of such factual concomitance of mental and bodily states as any psychological theory must take for granted; too little to show why the theory of parallelism should be preferred to the older theory of interaction. Dr. Stout seems to admit that the notion of two parallel but unconnected series is finally unthinkable, and needs to be relegated to the position of a working hypothesis. But does he show why, *as a working hypothesis*, the old-fashioned notion of interaction will not serve our turn equally well? The metaphysical monism to which he resorts as the philosophical "explanation" of parallelism, besides being stated in terms of probably intentional vagueness, seems just as well suited to be an explanation of "interaction". If we are, for working purposes, to violate logic as it must be violated by the doctrine of the parallel series, we ought at least not to do so without proved and urgent necessity, and proved and urgent necessity is just what, as it seems to me, Dr. Stout's third chapter fails to establish. If the mental order and the physical are really one and the same, what becomes of the assumption, in psychology, that mind and body, because disparate, cannot interact?

Dr. Stout is usually so accurate in his statements of fact that a reviewer does not readily find any little errors to correct. I would however call attention to a number of oversights on pages 541-543 of the generally admirable chapter on "Self as Ideal Construction". The wording of the last paragraph on page 541 is almost certain to suggest to a reader not otherwise aware of the facts that Anaximenes and the other pre-Socratics are brought forward to illustrate the survival of materialist doctrines of the soul after Plato. The ascription to Heraclitus of the doctrine that the soul is derived from the surrounding "air" is probably erroneous. Air plays no part in the physics of the Ephesian as far as can be shown from the actual fragments. It was probably the "fire" in the world at large that he supposed to be inhaled in respiration; the identification of "what surrounds us" with "air" is a piece of later exegesis. The doctrine of the duality of the soul referred to on page 542 was surely more of a rarity in mediæval psychology than the language used by Dr. Stout suggests. It was always regarded as a heresy by the orthodox philosophers though it had some vogue with the thinkers of the Renaissance period. The quotation from Bacon at the top of page 543 has apparently been misunderstood. Bacon explicitly gives the faculties there enumerated as belonging to the soul as compounded of the rational and irrational elements, as appears from an examination of the context (*De Augmentis*, iv., 3).

A. E. TAYLOR.

Studies in John the Scot (Erigena). By ALICE GARDNER. London: Henry Frowde, 1900.

How many students of philosophy have read Erigena? and how many could distinguish him accurately from his namesake, Duns Scotus—"of unhappy reputation," as Miss Gardner rather unkindly adds? Certainly Erigena deserves to be studied, if only that we may see how little modern idealism has advanced beyond this keen thinker, who knew some Greek but not much, and lived in the ninth century. Miss Gardner deserves warm thanks for her gallant attempt to rescue a great name from oblivion, and her little volume, which is most carefully and accurately written and amazingly adequate considering its brevity, ought to stimulate many readers to further study. It contains a chapter on the life and times of Erigena, another on his doctrine of God, a third and fourth on the Predestinarian and Eucharistic controversies, a fifth on his view of the final restoration of the world to unity, a sixth on his idealism, and a seventh on his influence in later times. It would have been better if the sixth chapter had been placed second, as it is really the key to everything else. And we should have been grateful for a brief comparison of Erigena to Kant and Hegel, with whom he has much in common, and to Berkeley with whom he has more.

Space forbids us to enter into many details, but probably Miss Gardner will not complain if a brother traveller in these out-of-the-way paths explains how he differs from her in regard to the difficult passage in the beginning of the *De Divisione*, where Erigena lays down his theory of the object of cognition. At the outset he gives four divisions of Nature (*quod creat et non creatur*, etc.), which form in fact the ground-plan of his book. But, before entering on his argument, he finds it necessary to explain what he means by "*is*" and "*is not*". Accordingly he proceeds to state five views of Being and Not-being. The first is that what can be grasped by sense or intelligence (Accidents, Phenomena) *is*; what cannot be so grasped (Substance, God) *is not*. Here it is to be observed he departs in a very curious way from his Neoplatonist authorities, who held that all substances except God were intelligible, and that, therefore, God alone *is not*. Whether Erigena made this remarkable alteration because he differed from the Neoplatonists, or because he did not understand them, is hard to say. The Neoplatonists, like Hegel, identified substance and phenomena, and Erigena appears to do the same. Matter, like Proclus, he absolutely rejects; privation, he says, *penitus non est*; it is not a part of Nature in any sense. The second gives the favourite Neoplatonist view of Nature, as a chain or hierarchy, extending from God to the lowest created thing. In this chain every link except the highest *is* and *is not*. That which is nearer God is unintelligible, *is not*, to all that is below it; that which is farther from God is intelligible, *is*, to all that is above it. A corollary from this is the famous Neoplatonist doctrine of Receptivity. Like his masters Erigena does not by any means accept the average conscience or intelligence as the standard of truth. Some men see far more than others. In the third he states and rejects the vulgar sense of the words *is* and *is not*. But in the fourth he gives as "not improbable" the ordinary Greek view that things *are* when they are comprehended by the pure intellect, and that objects of sense knowledge (*genesis*) *are not*. The reason why he admits this view as tenable is evident from the fifth distinction in which he accepts the view that evil *is not* while good *is*. Here he falls into a patent contradiction. For if evil is not a substance, and if it is below, not above, intelligence, it *is*. If it *is not* (and in many important points his argument depends on this premiss) it is eternal and divine.

Many other most interesting points are raised by Miss Gardner's volume. Let us touch upon one more. Erigena is perhaps the only author who explains quite clearly what is meant by the *Via negativa*. God is all, but all is not God; God is Love, but Love is not God, because He is more. He is the unity of contradictions (*Motus* and *Status*). Here we have the difference between the Mystic and the Pantheist on the one hand, and between Erigena and his modern successors, Kant and Hegel, on the other. What a field for speculation opens out here! Let us only observe that Erigena, like Dionysius and the Neoplatonists, leaves out the greatest of contradictions, that between joy and sorrow: and this omission makes his work a philosophy and not a religion. Indeed it makes it an imperfect philosophy, because the task of philosophy is to explain and account for the conceptions of religion, and of all these conceptions none goes deeper than that of union through pain.

A Critical Essay on Berkeley's Theory of Perception. By IKBAL KISHEN SHARSHA (Pandit). Allahabad. Pp. 123.

This is a sound inquiry into the main doctrines of Berkeley's philosophy. The author, after shortly pointing out in his introduction the most conspicuous misconceptions of Berkeley's idealism, begins by formulating and commenting on the proofs which the philosopher adduces of his principal doctrine that the sensible world is "in the mind". He then proceeds to what seems to me one of the best parts of his treatise: he discusses the relation of the "idea" to the "mind," a subject regarding which Berkeley contradicts himself. For "he tells us that the idea has a necessary relation to the mind, and is at the same time of opinion that the mind and the idea are two distinct things". One has to choose between these two opinions. The latter is adopted by Prof. Fraser, who, taking Berkeley at his word, asserts it to be wrong to regard the idea as a mode or attribute of the mind—not to mention here Mr. Collings Simon, who "spent thirty years of his life in trying to master Berkeley's philosophy and to explain it to others," and yet failed, as our author rightly remarks, to produce anything but a fanciful caricature of his system. Our author himself takes the other view, and I think he is right in maintaining that the existence of a necessary relation between the sensible object and the mind is of the very essence of Berkeley's idealism, and that this points to the conclusion that the idea must indeed be regarded as a state or mode of mind; he tries to show why Berkeley saw no inconsistency in his own doctrine, as stated above. Then follows, under the heading "The Idea as Objective," an interesting discussion of the relation of the finite to the infinite mind, that is to say: of the problem whether, according to Berkeley, the idea, as it exists in the mind of man, is the same as it exists in the mind of God. The reality of the sensible world is at issue in this part of the inquiry, which again serves to bring to light conflicting elements in Berkeley's philosophy.

After thus treating, in part i. of his essay of "The Sensible World," the author proceeds to deal, in part ii., with "The Supersensible," and his chapter on "The Cause of the Idea" provides a transition from the one to the other. The answer given by physiology as to the cause of the idea cannot satisfy the metaphysician. To him that answer would amount to the same as if one tried to explain the origin of a building by saying: "Out of the building came the walls, the doors, and the roof; they gathered together and formed the building".

Berkeley never underrates the importance of physiology or any other of the physical sciences which investigate the laws that define the order

of phenomena. Here he completely sides with Hume and his theory of custom. But, on the other hand, he thinks that the *true* cause of an effect must have "power" to produce it, and is, therefore, to be looked for not in the world of phenomena, of "ideas of sense," of matter, of things perceived, where there is no "substance," but in the world of things perceiving, of spiritual "substances," forming the ultimate reality of the Infinite Mind; and mind, in so far as it is "will," is the true cause looked for—a striking approach, by the way, to Post-Kantian speculation! According to Berkeley there are only the two sides of existence just named, and no "third natures," an attitude which he himself, as our author justly observes, greatly impaired in *Siris*, the work of his later years. This attitude is, of course, diametrically opposite to modern agnosticism as represented by Huxley and Spencer, against whom the author tries to defend Berkeley's *Spiritual Substance* in his last chapters.

THEODOR LORENZ.

A Manual of Ethics. By J. S. MACKENZIE. Fourth Edition. London: W. B. Clive, 1900. Pp. xx., 472.

We welcome the fourth edition of Prof. Mackenzie's excellent manual. The chief alteration consists in a new chapter on "The Authority of the Moral Standard," which gives an account of the different sanctions which have been proposed, and shows wherein the moral authority consists. The other changes are unimportant.

Les Philosophes géomètres de la Grèce, Platon et ses prédécesseurs. Par GASTON MILHAUD. Paris: Alcan, 1900.

M. Milhaud is already known to students of Greek Philosophy by his volume of lectures entitled *La science grecque* (1893). The present work, like its predecessor, is based mainly on the researches of Paul Tannery; but it is Plato that forms the centre of interest, not, as in the earlier volume, the "Pre-Socratics". M. Milhaud's aim is to interpret Plato afresh in the light of the fact that he was a mathematician, and he is well qualified for the task, being himself a mathematician and a philosopher. He has produced a book which ought to be read by every student of Greek philosophy; for it at least suggests the solution of what is really the great problem of the subject. No one can help feeling that Aristotle misunderstood Plato, and yet it seems impossible to believe that he should have done so. If M. Milhaud is right, the point at which misunderstanding arose is one that belongs to the province of mathematics. Now Aristotle's mathematical views are notoriously crude, and it would help us very much if we could accept M. Milhaud's thesis.

In an interesting introduction, the influence of Mathematics on Philosophy is discussed. How will philosophers who are mathematicians differ in their attitude towards certain problems from those who are not? The philosopher who is also a mathematician will be a dogmatist (not in the bad sense) and an idealist. He will be more inclined to mechanical than to dynamical theories and he will regard the infinite as real. This introduction is extremely suggestive, and at once puts us at the right point of view for understanding the chief problem of the work.

Book I. gives us the History of Mathematics in the hands of the predecessors of Plato. It is first shown that Greek mathematics was strictly autochthonous and not in any sense derived from Egypt or

Babylon. We are taken in a masterly way through the now familiar evidence—the Rhind papyrus, the ἀριθμολογία and the rest—and the conclusion is shown to be unmistakable. There is nothing very new in this part of the work, but it may be commended to those who still have any doubts on the subject. It is now, however, generally admitted that the Egyptians and Babylonians had no mathematics, nor the Hindus either till after the Greek invasion. M. Milhaud then goes on to show how the mathematical knowledge systematised in the elements of Euclid was gradually built up from the days of Thales onwards. In doing this, he makes a critical use of the fragments of Eudemos preserved in the commentary of Proclus, and is careful to avoid the error, into which even Cantor has fallen to some extent, of attributing to the earliest inquirers all the knowledge that was afterwards seen to be implied in their discoveries. The only thing that calls for criticism here is the occasional use of modern symbols. It is, no doubt, quite true to say that the Pythagoreans gave the name of “triangular numbers” to “numbers obtained by the summation of consecutive integers $\left(\frac{n(n+1)}{2}\right)$ ”; but the Pythagoreans would not have understood such a statement, and it produces an unhistorical effect. The symbols by which we express a truth are not indifferent; for they imply a relation to other truths, which may profoundly affect their significance. On the whole, however, M. Milhaud avoids this particular fault. It is satisfactory too to find that he is no longer convinced by the arguments of Teichmüller and Tannery that Anaximander meant by τὸ ἀπειρον the qualitatively indeterminate. He does not, indeed, find the solution of the difficulty where it clearly lies, in the doctrine of a plurality of worlds, but he sees that there is no evidence for the identification of the “eternal motion” with the diurnal revolution, and that the boundlessness of the primary substance is quite consistent with the sphericity of the οὐρανός. The account given of the Pythagorean view that things are numbers, marks a great advance on most expositions of this thorny subject. It is now admitted that the Pythagorean points or units had magnitude, and all the rest follows. It is quite true that the fact of incommensurability was known to the Pythagoreans, and that it is fatal to their way of regarding all quantity as discrete; but this is just the criticism of Zeno, and, if the Pythagoreans had seen the consequences of the fact that the side and the diagonal of a square have no common measure, Zeno would have had nothing to criticise.

Now, according to M. Milhaud, it was just this fact of incommensurability and the consequent necessity of regarding quantity as continuous that Plato made the centre of his system. This is worked out in Book II. We do not know the details of what Plato taught in the Academy, but we do know that it was mainly mathematical. Freed from all mythical embellishments, the theory of “Ideas” appeared in Plato’s later teaching, at least, in a purely mathematical form, and it was this form of it that Speusippus continued to maintain and that Aristotle tried to criticise. And M. Milhaud has actually succeeded, at least to some extent, in lifting the veil of mystery which covers the “Ideal Numbers”. The relation of the one to what was called in the school the ἀόριστος δυνάς of the great and small, the finite and the infinite, is the point in which the “Forms” are identified with the “Numbers”. But—and this is the chief thing to note—this was no mere revival of Pythagoreanism; for the concept of number had undergone a radical transformation by the introduction of the ideas of Continuity and Limit. And this is what Aristotle failed to understand. He had never really grasped the fundamental notions of

the new geometry, and instinctively regarded number as no more than a total of juxtaposed units. Number, he still believed, was always formed by addition; two is formed after one by the addition of another unit. It is a serious misunderstanding, no doubt, and we may hesitate to ascribe it to Aristotle; but it is difficult to resist the force of M. Milhaud's exposition. If he is right, he has at last put us on the way of giving an intelligible account of Plato's later theory of Ideas, and of the fact that Aristotle seems to criticise as Plato's views which we cannot bring ourselves to believe that Plato ever held.

JOHN BURNET.

Zur Analyse der Unterschiedsempfindlichkeit. Von LILLIE MARTIN u. O. E. MÜLLER. Leipzig: Johann Ambrosius Barth, 1899.

The research of which this book is an account may be regarded as a continuation of those of Müller and Schumann, and as designed mainly to test further the theory put forward by them: "Ueber die psychologischen Grundlagen der Vergleichung gehobener Gewichte".¹ Briefly, the theory is this: That if asked to estimate a weight, one innervates the appropriate muscles to an extent judged to be sufficient, and that the dictum uttered as to its weight depends not on sensations of pressure or strain, but chiefly on the rapidity with which the weight rises from the table. The amount of innervation employed is dependent on circumstances, e.g., on the size of the object; whence the common illusion that a pound of lead is heavier than a pound of feathers. In these experiments it would however appear to have been determined largely by the average of the weights employed in each series; or, which happened to be the same thing, by the standard weight with which the variable weights were to be compared, and which was lifted in each experiment; with the consequence that the variable weight frequently gave the impression of 'absolute' lightness or heaviness, more especially if it happened to be the one lifted last, and was therefore the one with reference to which the judgment was expressed.

After describing at length the procedure adopted in these experiments (which were all by the method of right and wrong answers) the authors, in the second chapter, show by examples from their own and other results, that the simple theory of Fechner is inadequate to explain them. According to Fechner, the effects of the differences in time and space order between the liftings of the two weights in each experiment, might be represented by substituting $(D \pm p \pm q)$ for the actual difference, D , between the weights; where p and q are constants, whose sign only depends on the order in time and space of the two liftings. The authors have indeed traced errors of this nature (Fechner's time- and space-errors). It would however follow if this was all, that if with one pair of weights we make an equal number of experiments in each of the four possible time and space orders, the errors p and q should disappear from the average of the results, which, however, is far from being the case.

In the next chapter the consequences of the Müller-Schumann theory are carefully worked out, on the assumption that the innervation given is mainly determined by the standard weight (*Grundgewicht*); and it is shown that there would result a 'General Tendency' to a larger proportion of right answers when the standard weight is lifted first, and consequently the impression of absolute lightness or heaviness, which would most frequently occur with the variable weight, has the best

¹ *Pflüger's Archiv*, 45, 1889, p. 37 ff.

chance of determining the answer, which in the main portions of these experiments referred always to the second weight. This is amply confirmed by the results recorded; but besides this 'General Tendency' to greater success when the standard weight is lifted first, the analysis shows that the number of correct answers also depends on whether the standard weight, G, is less or greater than the variable weight, V, and this to a degree which cannot be accounted for merely by Weber's law. For in this respect observers may be divided into two classes: the Positive Type, who give more correct answers when G is greater than V; and the Negative Type, with whom the case is reversed. It appears that the Positive Type is associated with greater power and energy in lifting; nearly all the ladies taking part in the experiments were of the Negative Type; and in the case of the only gentleman who belonged to it, there seems good reason to believe that he was in a weak state of health from overwork; it being moreover shown that the 'type' generally alters in a negative direction during the course of each day's experiments, presumably from the effects of fatigue.

In the latter part of the book the authors exhaustively discuss the experiments; showing statistically the effects of fatigue, practice, the weights employed, and so on, upon the three kinds of error they distinguish; namely, the Fechner's error, the 'General Tendency' and the Type error.

If I may be allowed a criticism it is that they perhaps hardly emphasise sufficiently the fact that at any rate the two latter kinds of error are dependent upon, if not peculiar to, the particular methods of experimenting which they have adopted; and that Prof. Müller is, perhaps, too severe upon Herr Wreschner for striking out a line of his own in this respect. It is interesting therefore to note that Herr Wreschner's results, even when analysed by Prof. Müller's methods, show in two important respects peculiarities which Prof. Müller regards as anomalous. In the first place, the 'General Tendency' is not observable, and in the second, this is the only case in which Prof. Müller has found the Negative Type associated with a Positive Fechner's time-error.

In saying this, however, I do not wish to imply that the methods adopted by the authors were ill chosen, or that they were wrong in confining themselves almost exclusively to one method. On the contrary, the fact that they chose a method which gives scope to the 'absolute impressions' of weight, and that they investigated the effects of these absolute impressions so exhaustively is just what makes of this treatise so valuable a contribution to the literature of Experimental Psychology.

EDWARD T. DIXON.

Das Grundgesetz alles neuro-psychischen Lebens: Zugleich eine physiologisch-psychologische Grundlage für den richtigen Teil des sogenannten materialistischen Geschichtsauffassung. Von JULIUS PIKLER, Dr. der politischen Wissenschaften, Prof. der Rechtsphilosophie an der Universität, Budapest. Leipzig: J. A. Barth, 1900. Pp. xvi., 254. Price m. 8.

Current theories, according to Prof. Pikler, fail in three ways. They assume reflex action to be the fundamental fact of neuro-psychical life, and try to explain it as such; they assume association to be the simplest and most primitive kind of mental connexion, and try to find a correlative for it; they neglect the really primitive and fundamental nervous processes on which 'vegetative life' depends. The

true problems are to discover the material correlatives of pleasure and unpleasure, the mechanical cause of the movements which maintain the pleasant and reject the unpleasant, and the material correlative of comparison and discrimination. The author's theory is that the reflex-arc is really, not an arc, but a circle: every stimulus tends to produce all possible movements, but that movement gains priority and strength whose reaction upon the central nervous system supports and strengthens the 'constant vegetative nervous process,' such a supporting reaction being subjectively experienced as pleasant. Dr. Pikler has certainly stated important problems, and up to this point his very ingenious theory, though entirely unsuccessful in detail, is worthy of careful consideration. He fails in detail—as, *e.g.*, in his more precise theory of pleasure (p. 233), in his explanation of movements which have a favourable or unfavourable effect only on completion ('*endzweckmässige Bewegungen*'), and in many other points—not least because, as he himself admits, the book has been rushed into print and the most eminent physiologists have been consulted after and not before it was completed. This is still more true of the explanation of comparison and discrimination. Dr. Pikler calmly throws over every kind of localisation, and maintains that "all conscious states are subjective epi-phenomena of the interaction of different movements in the same particle of nervous material". Likeness and equality depend on the similarity and identity of direction of these movements, difference upon their conflict. What the nervous process or 'movement' is Dr. Pikler naturally cannot tell us; to its 'direction'—ever recurrent term—he attaches two or three really distinct meanings; of the 'particle of nervous material' he offers no attempt at explanation. This sort of writing is worse than purely formal; it is liable to mislead. These deviations of outsiders into physiology merit condemnation just as much as psychological theories based on non-psychological data; Dr. Pikler has no idea of the difference between criticism and intrusion. Yet his book, for the sake of its earlier pages and because of the ingenuity exhibited throughout, is worthy of careful perusal.

T. L.

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IX.—PHILOSOPHICAL PERIODICALS.

PSYCHOLOGICAL REVIEW. Vol. vii., No. 4. **J. McK. Cattell.** 'On Relations of Time and Space in Vision.' [Introduction : perception with the moving eye ; the fusion of moving objects. Experiments : colours and brightnesses passed, at known rates, behind a window. Results : (a) when objects are moved slowly over a limited visual field, they are not seen one after the other at the place where they are exhibited, but seem spread out over a larger area than can be seen. When successive white or coloured surfaces pass over a limited field of vision so rapidly that the eye cannot be moved while they are in view, the stimuli do not seem to follow one another, but are perceived simultaneously side by side, variously arranged and commingled. (b) Large individual differences appear in the perception of the same stimulus under these artificial conditions. (c) When the eyes are moved so that the line of sight passes over objects, we have one after another stimulating the same retinal field, but we perceive the objects simultaneously side by side. The different results with the moving eye and with moving objects prove that the phenomena of fusion and colour-vision are cerebral and mental rather than retinal—valuable results, but capable of other systematic interpretations. Especially to be deprecated is the author's appeal to teleology as furnishing a causal explanation.] **R. S. Woodworth and E. Thorndike.** 'Judgments of Magnitude by Comparison with a Mental Standard.' [Judgments of weight, length, area. Judgments of comparison with a mental standard do not follow Weber's law ; in such judgments as we ordinarily make in life there are many factors, besides the magnitude of the thing judged, which affect the accuracy of the judgment.] **A. H. Pierce.** 'A New Explanation for the Illusory Movements Seen by Helmholtz on the Zöllner Diagram.' [Criticism of theories of Thiéry, Helmholtz, Judd. Explanation in terms of peculiarities of the movement of stimulations upon the retina : confirmation from rate, excursion, behaviour of the eye in respect to rest, movement and kind of movement, direction.] **M. W. Calkins.** 'Elements of Conscious Complexes.' [We must distinguish : substantive or sensational elements (sensational qualities and intensities) ; attributive elements (affections) ; and transitional elements. The first predominate in the percept and the image ; the second in emotion, belief, volition ; the third in judgment, recognition, memory, conception.] Discussion and Reports. **H. H. Bawden.** 'The Functional Significance of the Terms "Sensory" and "Motor".' [The customary distinction between the sensory and the motor aspects of the organic circuit is arbitrary. "It furnishes us with no psychological differentia at all, because the attempt is made to make the distinction one of content rather than of function. But viewed simply as functional phases of the process of adjustment or co-ordination, the distinction (*sic* !) has a positive value." Where this antithesis is not implied, 'kinæsthetic' should replace 'motor'.] **C. K. Wead.** 'Dr. Meyer's "Elements of a Psychological Theory of Melody".' [Critique of Meyer's doctrine of

relationships. Historical sketch of theories; directions for reading.] Psychological Literature. New Books. Notes.

PHILOSOPHICAL REVIEW. Vol. ix., No. 4. **J. Sully.** 'Prolegomena to a Theory of Laughter.' [General sketch of theories; insistence on the complexity of the phenomena. Critique of Lipps' theory. Immediate apprehension of the comical.] **J. G. Hibben.** 'Practical Procedure in Inference.' [Discussion of the canons of inference which provide a working method in ordinary reasoning. Instances of syllogisms, formally faulty, really valid. "Every inferred element may be referred to a given system whenever it is recognised that the element in question is essential to the integrity of that system": instances from the logic of analysis, of identification and of elaboration. Variations in logical force; possibilities of valid inference from foregone assessments of logical value. Educational significance of a qualitative as against the quantitative canon.] **A. Lefevre.** 'Butler's View of Conscience and Obligation.' [For Butler, moral discrimination has both a cognitive and an affective aspect. Conscience is both an intellectual reflexion and an approval and disapproval; and although the discernment of right or wrong is *a prius* to the feeling, both terms are essential. Examination of the objections (a) that Butler is guilty of a circle in defining: "we disapprove immoral actions, and immoral actions are those which we disapprove"; (b) that his treatment of ethics is purely statical, lacking all idea of growth; and (c) that he uses God as a *deus ex machina* to explain morality. The criterion of morality is rationality, though not in Kant's sense. "Virtue is not bare logical consistency, but self-consistency; and vice is not bare logical contradiction, but self-contradiction." Butler thus anticipates self-realisation.] **H. M. Stanley.** 'What Constitutes a Thing?' [Physics "points to the thing as temporal-spatial appearance of correlated activities; evolutionary psychology points to the thingness of the body as the appearance of correlated psychical activities". "The suggestion of science to philosophy is that the totality of things in time and space are appearances of a dynamism physical and psychical, an activity which in part is mere energy, whose determining quality is yet unanalysed, but in part is the will effort of the struggle of existence in organisms."] Reviews of Books. Summaries of Articles. Notices of New Books. Notes.

AMERICAN JOURNAL OF PSYCHOLOGY. Vol. xi., No. 3. **E. B. Huey.** 'On the Psychology and Physiology of Reading (I.)' [(1) Eye movements. Method of direct registration of eye movements: *cf.*, Huey and Delabarre, *American Journal*, July, 1898. The eye moves line by line, forward in quick jerks, backward in an unbroken sweep. (2) Speed of eye movements. The forward movement occupies a constant time, irrespective of the arc traversed. The backward movement has a small *m. v.* whether for time or extent. (3) Reading pauses. The times are very variable. Comparison with the reaction-time of the eyeball to word stimuli. The reading pause is shorter: partly because of associative expectancy, partly because of peripheral prevision. (4) Word perception and extent of the reading field. Lengths of reading matter correctly read on exposed cards, to right and left of the fixation point, without context, and with context to within 2 cm. of the fixation point.] **J. W. Slaughter.** 'Disturbances of Apperception in Insanity.' [Attempts to apply the recent doctrine of apperceptive 'systems' to the study of delusional insanity.] **E. J. Swift.** 'Sensibility to pain.' [Correlation of the pain limen (temporal algometer) with age, sex, mental ability and mental fatigue.] **G. E. Partridge.** 'Studies in the Psycho-

logy of Alcohol.' [(1) Intoxication among primitive and civilised peoples and among animals. (2) The state of intoxication: all drugs in common use are stimulant-narcotics. The pleasure of the state is due in part to the wide range of emotional tone. (3) A study of cases of inebriety. (4) Effect of intoxication upon literature and language. "No other thing except the sexual relationship has made a deeper impression upon the popular language." (5) Analogues of the intoxication impulse: animal plays, outbursts in primitive peoples and in civilised adolescence. (6) Theories of the impulse: sin; craving for relief from pain, etc.; diseased appetite; animal lust; acquired taste; secondary instinct; instinct to intensify consciousness; desire to change relation of common sense to individual sense; instinct which is a by-product of human evolution. (7) Outline of new theory: the impulse is "one form of expression of a general instinctive tendency, which has developed in the race as an aid to mental growth". This tendency is that "to seek intense states of consciousness". Intoxication, as an expression of the tendency, has been favoured by the assistance it gives to the social consciousness. We must also take into account the narcotic effect of intoxication, and the impulse in certain societies to revert to a *less* intense form of life. (8) Experimental: the effect of small doses of alcohol upon muscular and mental ability. Addition is quickened to the end of the second hour; reading, writing and muscular action show a period of quickening followed by retardation.] **G. M. Whipple.** 'Two Cases of Synæsthesia.' [Record of exhaustive laboratory tests. The questionnaire method is inadequate. Variation is great, even in the same individual. The determination of genesis is always difficult: here it proved to be impossible. All that can be said is that the secondary sensations may be conjoined directly or indirectly (by way of organic sensation) with the primary. Generalisation is therefore to be avoided (critique of Bleuler and Lehmann). Notes of taste photisms, and of pain, pressure and temperature phonisms.] **I. M. Bentley.** 'The Synthetic Experiment.' [Experimental analysis may be tested by experimental synthesis. Discrimination of the synthetic perception from the 'illusion'. Types of experimental synthesis: Kirschmann's lustre, Wundt's reflexion, emotion (especially on the James-Lange theory), action (the reaction experiment). The perception of liquidity: analysis, and progressive attempts at synthesis. "The first step was the bringing together of pressure and thermal conditions, in the simplest, though the most artificial way. . . . The actual substance used made little difference, so long as it brought together the essential elements in the necessary mode of combination. Having built up completely our perception, we turned to Nature for a hint as to refinement of method. . . . Taking from her the ingredients which our previous experiments had shown to be essential, but rejecting her superfluous ingredient, 'moisture,' we got the neatest synthesis so far obtained."] Psychological Literature. Notes.

INTERNATIONAL JOURNAL OF ETHICS. Vol. x., No. 4. **Mary A. M. Marks.** 'The Treatment of Subject Races.' [A plea for a more sympathetic treatment of subject races, particularly those of India. The relation of conqueror to conquered is essentially demoralising. The Indian famine is due to our mismanagement, and warns us to pause in our imperialism.] **H. E. S. Fremantle.** 'Liberty and Government.' [What are the proper boundaries of individual liberty? *Laissez-faire* which was provoked by overgovernment in the past, is theoretically indefensible. Mill and Spencer criticised. The true principle is to produce a rich individual nature in all the citizens. This principle may be extended to international relationships.] **J. S. Mackenzie.** 'The

Source of Moral Obligation.' [Indifference to the question, Why are we bound to do right? is only suitable to an Age of Faith; not to the present Age of Inquiry. The need of answering the question is forced upon us by the new problem of imperialism. It is antiquated to regard the state or God's will or conscience as the source of moral obligation. The true source is the demand that human powers should be completely realised. Imperialism is only justified so far as it helps this.] **W. G. Everett.** 'The Relation of Ethics to Religion.' [While the source of morality is in man's social relations, that of religion is in his relation to cosmic forces which produce in him the idea of infinite power. The moral element in religion is of human growth. Morality, though significant for metaphysics, must be interpreted unmetaphysically. Religion develops through ritual and dogma into morality. Theoretically, religion is based on ethics. Religion can never be merged in morality.] **H. Davies.** 'The New Psychology and the Moral Training of Children.' [The new psychology in helping us to understand the child's mind is extremely valuable for education. It frequently, however, commits the mistakes of (a) underestimating the complexity of the child's mind, (b) failing to do justice to his ethical nature, (c) perverting the ethical aspect of child-training.] **M. Jastrow, junr.** 'The First International Congress of History of Religions.' [Sketch of the work done in this field by the French. Programme of the Congress at Paris in connexion with the Exhibition.] Discussions by **J. M. Robertson** on 'The History of Freethought,' and by **G. D. Ritchie** on 'Dr. Mackintosh and Intuitionism.' Book Reviews.

REVUE PHILOSOPHIQUE. No. 10, October, 1900. **E. de Roberty.** 'Morale et Psychologie.' [Sociology must not be confounded with biology on the one hand or psychology on the other. It is concerned with the transmutation of the biological manifold (the race) into a supra-organic unity (the community) and with the metamorphosis of organic unity (egoism) into a supra-organic multiplicity (altruism). It is, in fact, identical with ethics.] **G. Milhaud.** 'Les lois du mouvement et la philosophie de Leibniz.' [Traces the influence of Leibniz' study of physics on his metaphysical theory.] **Novicow.** 'Les Castes et la Sociologie biologique.' [An answer to M. Bouglé's article: 'La Sociologie biologique et le Régime des Castes' in the April number of *Revue Philosophique*.] **A. D. Xénopol.** 'Les Sciences naturelles et l'Histoire.' Notes et discussions. Revue critique. Analyses et comptes rendus. Revue des périodiques étrangers (MIND). No. 11, November, 1900. **H. Taine.** 'De la Volonté: Fragments inédits.' [A fragment of a treatise on psychology. The main headings are: (a) Conflit des Tendances, (b) La Tendance fixée, (c) Influence de la Tendance fixée.] Les Congrès internationaux de 1900. Correspondance. Revue des périodiques étrangers. No. 12, December, 1900. **Murisier.** 'Le Fanatisme religieux: Étude psychologique. Bos (Camille). Contribution à la Théorie psychologique du Temps.' [Our perception of time is based on the immediate intuition of the rhythmic vibrations of the nerve-elements.] **Palante.** 'Le Diletantisme social et la Philosophie du "Surhomme".' [Both are forms of social nihilism; but while the former protests against society in the interest of the instinct of beauty, the latter does so on behalf of the instinct of grandeur.] Revue générale. Analyses et comptes rendus. Notes et documents. Revue des périodiques étrangers.

REVUE NÉO-SCOLASTIQUE. No. 25. **D. Mercier** ('Le bilan philosophique du XIX^e siècle') passes in review the theories of the traditionalist, eclectic, positivist, and other schools of thought of anti-metaphysical

bias. He points out that even when positivism was at the height of its popularity the claims of metaphysics were allowed by such men as Von Hartmann, Lotze, Paulsen, Vacherot, Janet, and others. He quotes Wundt as admitting that Aristotle's view of the soul as "the first entelechy of the living body" succeeds better than other psychological theories in accounting for the facts of experience, and calls attention to the argument recently employed by Richet in favour of final causes. **C. Fiat** ('La Substance d'après Leibniz') maintains that the theory of Leibniz is a return to the doctrine of substantial forms, for with Leibniz, as with Aristotle, substance comprises two essential co-principles, of which one is active and the other passive. But, as restated by Leibniz, the theory acquires a new significance. The extension of bodies is no longer an absolute property; it exists only in thought, and is purely phenomenal. Form is a force with the distinctive qualities of perception and appetite. Matter, as distinct from extension, properly so called, is an internal limit of activity. **G. Legrand** ('Deux Précurseurs de l'idée sociale catholique') gives De Maistre the credit of having anticipated Taine in describing as the two fundamental errors of the French Revolution the legislation for "man in the abstract," and the supposition that it is possible by means of legislative decrees to establish off-hand institutions that will endure. The fault apparent in De Maistre's writings is an excessive liking for deduction. In the domain of politics and sociology the inductive method ought to have the preference. De Bonald, with many excellent qualities as a thinker, was inclined to combat extremes with extremes. He is unable to challenge Rousseau's doctrine of the sovereignty of the people without advocating an exaggerated view of the authority of the State. He cannot oppose the extreme theory of individualism without unduly laying stress on the importance of society. But, with all their faults, De Maistre and De Bonald may claim the merit of having restored those fundamental principles of the Christian social order which the Revolution had attempted to sweep away.

ZEITSCHRIFT FÜR PSYCHOLOGIE UND PHYSIOLOGIE DER SINNESORGANE. Bd. xxiii., Heft 1 und 2. **F. Schumann**. 'Beiträge zur Analyse der Gesichtswahrnehmungen.—I. Einige Beobachtungen über die Zusammenfassung von Gesichtseindrücken zu Einheiten.' [Experimental psychology must progress slowly, because there is much preliminary (methodological) work to be done, and because introspection is inadequate. Experiment, however, comes to the aid of introspection; and it is on the ground of introspective data that progress must now be looked for. (1) Instances of involuntary and voluntary grouping, of more and less intimate connexion of parts, etc., in various forms of visual perception. (2) Various meanings of 'unity'. It may mean approximation to singleness of impression; the persistence with which the complex as complex forces itself upon the attention; or influence as a whole upon ideational reproduction. The analogy with tones and tonal complexes. Unity as a form-quality (positive ideational contents: von Ehrenfels) and as an ultimate characteristic of complexes of elements.] **F. Kiesow** and **M. Nadoleczny**. 'Zur Psychophysiologie der Chorda Tympani.' [Experiments in two cases of otitis med. purulenta chronica. Confirmation of the view that the taste fibres for the anterior two-thirds of the tongue (from the peripheral end of the reg. fol. to the extreme tip of the tongue) must be contained in the chorda tympani. Stimulation of the central end of the chorda in the middle ear gives rise to a sour, metallic-sour or salt sensation in the region named. Observations on sensitivity to pressure, temperature, and pain.] **H. Munk**. 'Die

Erscheinungen bei kurzer Reizung des Sehorgans.' [(1) Colourless stimuli. The appearance of a threefold image is conditioned solely by the brightness-difference between centre and field; if this is diminished the phenomenon, though vacillating, is continuous. The effect of the brightness-difference is shown in the later occurrence of an increased contrast; if it be sufficiently diminished there is but one image. The contrast arises at a relatively early stage of the curve of fall; it is much stronger than the contrast during stimulation; it is separated from the stimulus by a contrastless interval. If a negative image is seen it comes after the positive images. (2) Coloured stimuli. The complementary phase is conditioned by the brightness-difference between centre and field; if this is diminished the coloured image rings off without colour change; the complementary image is positive. Contrast within a chromatic special sense is not able to evoke a complementary phase. If a negative complementary image is seen it comes after the positive phases.—Suggestions towards an explanation, in terms of Müller's theory of visual sensation.] **M. C. Schuyten.** 'Ueber das Wachsthum der Muskelkraft bei Schülern während des Schuljahres.' [Gain during ten months; monthly increase; negative results of the month of March; comparison of girls and boys; slow recovery of girls from the March effect.] **J. McK. Cattell.** 'Die Wahrnehmung gehobener Gewichte.' [Reply to Müller.] Besprechung. [**S. Witasek.** 'H. Münsterberg's *Psychology and Life*.' Literaturbericht. Heft. 3. **J. von Kries** und **W. A. Nagel.** 'Weitere Mittheilungen über die functionelle Sonderstellung des Netzhautcentrums.' [An inquiry prompted by the recent work of Tschermak and Shermann. Experiments with dichromatic and trichromatic eyes show that there is a central field for which the brightness-equations of brightness-adaptation hold after the longest periods of darkness-adaptation. The field is somewhat longer (88-107°) than it is high (81°): the position of the point of fixation within it is not central. Theoretical discussion.] **W. Thorner.** 'Ueber objective Refraktionsbestimmungen mittels meines reflexlosen Augenspiegels.' **J. Kodis.** 'Einige empiriokritische Bemerkungen über die neuere Gehirnphysiologie.' [Loeb and Bethe maintain that "the lower animals, up to those which possess an associative memory, have no consciousness, and must, therefore, be considered as mere mechanisms". Critique of this position, in terms of Avenarius' system. The untenability of a dualism; the equivocal use of 'consciousness'; the classification of experience (as characters and elements, things and thoughts, sensations, perceptions, and ideas). The fallacy of 'introjection'. Conclusion: the reduction of the lower animals to automata is due to a confusion of the mechanical and amechanical standpoints; and memory is not a mechanical (or objective) criterion. We must be content to describe, as physics does, and cease to strive for explanations.] Besprechung. '**O. Pfaender.** 'G. F. Stout's *A Manual of Psychology*.' Literaturbericht. Heft 4. **L. Steffens.** 'Ueber die motorische Einstellung: experimentelle Beiträge.' [An important paper, of which only the principal results can be outlined here. Introduction: confirmation of Müller and Schumann's theory of motor predisposition by experiments upon animals. (1) A motor predisposition is not transferred to the corresponding organ of the opposite side of the body. (2) The behaviour of concurrent predispositions: the rapid fall of predisposition, as indicated by the 'principal' experiments carried out to test it, is illusory, due to these experiments themselves; motor dispositions of different age fall or ring off side by side just as do variously aged reproductive tendencies of the psychical memory. (3) Distribution of a constant number of predisposi-

tion experiments over a time period of varying length: if the time interval between the last predisposition experiments and the principal experiments (made to test predisposition) is not too short, a wider distribution of the predisposition experiments leaves a stronger disposition behind. (4) It is true of motor predisposition as it is of psychical memory that of two regular modes of distribution the wider is the more favourable to retention. Given sameness of age, a motor predisposition rings off the more quickly in time (absolutely taken), the stronger it is.] *Literaturbericht.* Heft 5 und 6. 'Bibliographie der psychophysiologischen Literatur des Jahres, 1898.' [Gives 2746 titles, as against the 2558 of the *Psychological Index* of March, 1899.]

PHILOSOPHISCHE STUDIEN. Bd. xvi., Heft 1. **N. Alechisioff.** 'Reactionszeiten bei Durchgangsbeobachtungen.' [The investigation has two purposes: to analyse the different types of reaction, both under ordinary conditions (light pendulum) and in transit observations (red point on white field), and to ascertain the most favourable psychophysical conditions for astronomical transit work. (1) Every reactor has a 'natural' (central, mixed) reaction form, from which the sensorial and muscular (or complete and shortened) forms are variations. (2) The best observations are made if the reactor fixate the cross-lines of the telescope, and wait for the sense impression to pass from indirect into direct vision. (The star moves from 10° to 14° in the 1 sec., and the extent of the field is about 28°.) The time from entrance of the star into the field to transit must not exceed 1.15 sec. The reaction must be made "in the exact moment of perception of the transit". The principal disturbances come from lack of practice, lack of uniformity in the form of reaction employed, and eye movements.] **W. Wundt.** 'Zur Kritik tachistoskopischer Versuche.' —II. [Detailed (and successful) reply to the paper by Erdmann and Dodge, in the *Zeits. f. Psych.*, xxii., 241 ff.] **M. K. Smith.** 'Rhythmus und Arbeit.'—I. [First part of an inquiry into the effect of rhythm upon the quantity and quality of work, physical and mental. Distinction between forced and natural rhythms. Plan of experiments: ergographic tests, rhythmical writing, the effect of rhythm on the judgment of lifted weights, on memory, and on 'visual learning': the series becomes progressively less physical and more purely mental. Results: (1) the ergographic tests failed, since the observers fell into a rhythm, whether prescribed or not. (2) Seven series of writing tests gave results bearing on the difference between quality and quantity (shortening of total time, increased rapidity, promptitude of execution) in all kinds of work. Rhythm affects the latter characteristic. Besides the detailed conclusions from the series, the author notes the advantage of unification of children's work; the gain in accuracy and regularity; the saving of time; the disciplinary value of rhythm; and the musical value of the development of rhythmical susceptibility. (3) Weight experiments: procedure and apparatus. Eight experimental series.]

VIERTELJAHRSSCHRIFT FÜR WISSENSCHAFTLICHE PHILOSOPHIE. Jahrg. xiv. Heft 4. **E. Marcus.** 'Versuch einer Umbildung der Kant'schen Kategorienlehre.' [Kant was wrong in basing his table of Categories on the forms of judgment. The test of the completeness and organic unity of such a table lies in its power to enable us to reconstruct the general plan of experience in its completeness and organic unity. The writer holds that the Kantian table is not complete, that it is not fully systematised, and that at certain points it substitutes complex and derivative for simple and primitive conceptions. He proposes and defends a table drawn up by himself.] **Joseph W. A. Hickson.** 'Der Causal-

begriff in der neueren Philosophie.' [Hume is right in attacking the conception of efficiency or power as a tie between cause and effect. He is also right in denying that the nature of the effect can be determined in advance by mere analysis of the nature of the cause. But he is wrong in denying all intelligible connexion between cause and effect.] **Raoul Richter.** 'Friedrich Nietzsche.' [An obituary notice: enthusiastically appreciative.]

ARCHIV FÜR SYSTEMATISCHE PHILOSOPHIE. Bd. vi. Heft 4. **J. Bergmann.** 'Die Grundsätze des reinen Verstandes.' [Discusses the principles of Identity and Contradiction as respectively criteria of true and of false propositions. As applied to real existence these principles are mere tautologies. But there are two *real* principles corresponding to them—that of Sufficient Reason and that of Repugnance. Whatever is truly affirmed or denied of an individual thing has its sufficient reason in the essence of that individual thing. This proposition is explained and defended, and the conception of essence and accident thoroughly examined. An important article.] **Hans Kleinpeter.** 'Zur Formulierung des Trägheitsgesetzes.' [It is possible to define a system of co-ordinates and a normal motion, in relation to which all bodies move uniformly in a straight line, when deviation from this norm is not undeterminately definable in accordance with our other physical assumptions.] **Max Dessoir.** 'Beiträge zur Aesthetik.' Discusses the poetic representation of the psychical life of individuals. This involves sympathetic realisation, but at the same time a distinction between the artist himself and the imagined person. The sympathetic realisation is heightened by appropriate organic sensations and motor activity. Poetic experience is not *observation* but an apprehension which is complete because it is not limited by interest in ulterior ends. Poetic construction proceeds from the obscure scheme of a total personality to determinate detail.] **F. Tönnies.** 'Jahresbericht über Erscheinungen aus den Jahren, 1897 und 1898.' **B. Bosanquet.** 'Systematic Philosophy in the United Kingdom in 1899.'

RIVISTA FILOSOFICA. November, 1899. **L. Credario.** 'L'opera della Società per la Storia dell' educazione e della scuola tedesca.' **C. Cantoni.** 'Sul concetto e sui carattere della Psicologia' (2a. parte). **A. Piazzi.** 'A proposito di una recente pubblicazione pedagogica del Prof. Michele Kerbaker.' **G. Rossi.** 'Vico nei tempi di Vico.' **G. Vidai.** 'Intorno al "Fondamento della Morale".' January, 1900. **N. Fornelli.** 'Studio di Psicologia scolastica.' **E. Sacchi.** 'Sulla teoria platonica del delitto e della pena.' **A. Piazzi.** 'Il liceo moderno.' **E. Juvala.** 'Sul giudizio della condotta morale.' March, 1900. **C. Cantoni.** 'La corrispondenza di due filosofi.' **A. Piazzi.** 'Il liceo moderno.' **A. Groppali.** 'Di un opera di G. Marchesini.' **A. Faggi.** 'Per la Psicologia dei sentimenti.'

X.—NOTES AND CORRESPONDENCE.

TO THE EDITOR OF "MIND".

A few words from me seem needful to correct a profound misapprehension of my views expressed in your last number by Dr. Tolver Preston. He represents me as regarding our consciousness of Space as evolved from our consciousness of forces. His words are:—

"In his *Principles of Psychology* . . . Mr. Herbert Spencer ventures to suggest a particular theory, which makes Space and Time the resultants of a transformation passed through, where force is therefore (by implication) concerned, just as if it were a case of colour or sound. . . . If Space and Time be not resultants of force-action; may not this constitute some reason for regarding them as absolutes."

I am amazed by these statements. Throughout the chapters in which I have treated of the conceptions of Space and the Space-attributes of Matter I have in varied ways represented our Space-consciousness as resulting from our experiences of the *relations* among forces. In my view our Space-consciousness is an abstract from our experiences of all relations of co-existence and includes forces in no other way than as being the terms of the relations.

The remainder of Dr. Preston's criticisms are pervaded by derived misapprehensions.

HERBERT SPENCER.

BRIGHTON,
2nd December, 1900.

UNIVERSITY COLLEGE, LONDON.

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